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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

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For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

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Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

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Includes light phenomena.

75 PLASMA PHYSICS 118
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS 120
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 123
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 124
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 124
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 125
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 125
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 129
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 129
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 130
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 131
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 132
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 132

Note: N.A. means that no abstracts were assigned to this category for this issue.

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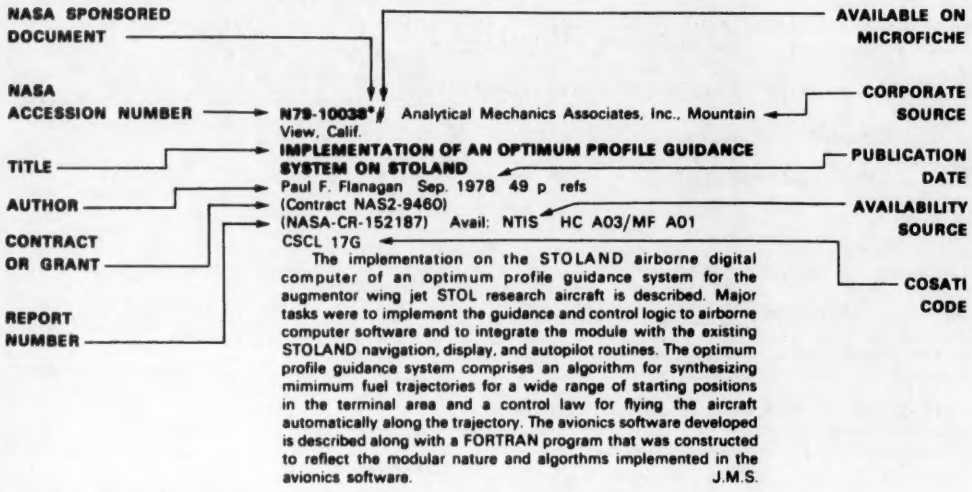
TYPICAL CITATION AND ABSTRACT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IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
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The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmentor wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing mimimum fuel trajectories for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorithms implemented in the avionics software. J.M.S.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects— not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, NAVTOLAND (NAVY VERTICAL TAKEOFF AND LANDING) CONTROL DISPLAY CAPABILITY
R. RINGLAND, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DN881385; N62269-77-C-0230)

To analyze the trade-offs between flight control and display complexity for V/STOL shipboard landings, and recommend optimum configurations. This contract supports work unit ZA601, Agency Accession No. DN681080.

Through literature searches and evaluation of flight-test data, develop a matrix of feasible and practicable control/display configurations. U (Sep 77-Dec 77) preliminary examination of the V/STOL terminal area mission phase breakdown has been initiated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0002, DUAL MODE PROPULSION SYSTEM
W.J. STONE, U.S. Navy, Weapons Center, *Ridgecrest, California* 93555 (DN782282)

Design, fabricate and bench test a system that will disable the rocket motor used on the Martin Baker Aircrew Escape System when an ejection attempt occurs while the aircraft is in a greater than 90 degrees pitch or roll attitude. This concept has the potential of reducing fatalities by 30 to 50 percent.

The F14 altitude reference system will be investigated to determine what type of output is available. Specifically it has not been determined if a discreet signal is available at plus or minus 90 degrees roll and pitch or if a synchro signal must be converted to a linear DC signal. A control system, based on results of the above investigation, will be will be designed and fabricated. The Martin Baker ejection seat sustainer rocket firing mechanism is actuated by gas pressure supplied by a cartridge. The cartridge is fired as the unit moves up the rails. Detailed information on the sustainer initiation system will be obtained and an explosively actuated line cutter or bypass valve designed and fabricated. The system will be bench-tested using a simulated aircraft altitude reference system output signal. The hardware used for testing will not be suitable for aircraft installation and flight testing of this system is considered beyond the scope of exploratory development.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0003, TRAVERSING CONCEPTS FOR V/STOL AIRCRAFT BASED ON SMALL AIR CAPABLE SHIPS
P.D. SORENSEN, Sandaire, *3777 Gaines St., San Diego, California* 92110 (DN881065; N62269-77-C-4002)

To support advanced V/STOL aircraft development programs by investigating traversing concepts that would extend the operational capability of existing and advanced air-capable ships. This contract supports work unit DH817, Agency Accession No. DN233057.

Develop and evaluate advanced concepts for a traversing system that would provide a rough seas traversing capability for V/STOL aircraft based on small ships. Lightweight, compact systems that have a minimum impact on the aircraft and the ship will be emphasized.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0004, ADVANCED AIR TRAFFIC CONTROL
F.D. QUEEN, U.S. Navy, Res. Laboratory, *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680218)

The near-term objective of the program is to establish a technology base in ATC to solve the problems of curved approach, flare, decrab, rollout, and taxi at tactical air fields under conditions of zero-zero visibility. The long-term objective is to provide a technology base for all-weather automated landings.

The technical approach to the near-term problem will include the assessment in the accuracy of aircraft attitude sensors, determination of measurement accuracies required in attitude and position, and development of sensors to meet the imposed accuracy requirements. Techniques using a variety of observables will be tested on a laboratory range or on an aircraft as appropriate. Development of the refined system for tactical aircraft will proceed using contractors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Electronics Systems Command

1.0005, A-10 GENERAL SUPPORT
J.A. ROBERT, U.S. Air Force, Armament Laboratory, *Eglin Air Force Base, Florida* 32542 (DF643880)

The objective of this work unit is to develop a capability for performing all A-10 compatibility analyses in-house. Achievement of this capability will enable the AFATL to generate all flight clearance recommendations involving external stores on the A-10 aircraft. (1) Air Force function - aircraft/stores certification. Deficiency or opportunity -in-house generation of flight clearance recommendations result in significant cost and time savings. The AFATL does not presently have an in-house capability for performing A-10 compatibility analyses. Objective - generate flight clearance recommendations for aircraft/stores compatibility in support of operational requirements. How work contributes - cost/time savings, enhances safety of flight.

Conduct/review aerodynamic, structural, and electromagnetic analyses and tests as appropriate to establish the capability for performing all A-10 compatibility analyses in-house.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0006, F100 HPC AEROELASTIC ANALYSIS
J. JEFFERS, United Technologies Corp., *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF461950; F33615-77-C-2105)

Improve understanding of blade flutter mechanisms by providing insight into parameters affecting blade instability.

Conduct a detailed aero/mechanical analysis of FX-208 and XD-11 test data generating a stall and choke flutter data bank for prediction system development, evaluate existing prediction

system capabilities/limitations, and assess the use of 'core' engines for full-scale engine HPC flutter clearance testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0007, AUGMENTOR COMBUSTION INSTABILITY INVESTIGATION

J.P. RUSNAK, United Technologies Corp., Pratt & Whitney Aircraft Group, *P.O. Box 2691, West Palm Beach, Florida* 33402 (DN789771; F33615-76-C-2024)

Develop a reliable analytical model to determine the rumble stability limits and characteristics of turbofan engine augmentors. A secondary objective is to model the heat release characteristics at a flameholder subject to longitudinal pressure disturbances.

Phase I consisted of model development in which concurrent experimental and analytical studies were conducted. The model was directed toward describing the stability limits and characteristics of the experimental rig. Phase II consists of model refinement and extension. The model will be computerized and extended to other less conventional augmentors. Phase III, model evaluation, investigates stability design improvements and should establish recommended development and test criteria for future augmentor development programs.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0008, ASSESSMENT OF AUGMENTED ELECTRONIC FUEL CONTROLS FOR MODULAR ENGINE DIAGNOSTICS AND CONDITIONING MONITORING

H.D. HOFFMAN, General Electric Company, Aircraft Engine Group, *1000 Western Ave., Lynn, Massachusetts* 01910 (DA0E3791; DAAJ02-77-C-0065)

To establish the requirements for, define the approach to be used, and assess the impact of including diagnostic and condition monitoring (D & CM) requirement features in the design of future advanced control systems for turboshaft helicopter engines.

The contractor shall identify the D & CM objective which could be accomplished by their inclusion in the design of a FADEC system. The parameters to be sensed shall be identified and the impact of integrating the D & CM objectives on the full authority digital electronic control (FADEC) system design shall be addressed. The feasibility of developing sensors and logic required for the FADEC/D & CM integrated system shall be identified.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0009, REPAIR OF BOMB-DAMAGED RUNWAYS

C.E. COLLUM, U.S. Army, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (DA0C8015)

To develop an improved rapid runway repair system or systems that will be responsive to both the variations in damage levels from an aggressor's attack and the operational requirements of the defense for both retaliatory and resupply efforts. These systems, which will include materials, equipment, and procedures, will be designed to reduce manpower requirements, reduce total repair time, improve the permanence of the repair, and reduce total repair cost over that of existing systems. In support of the system development, the strike threat, damage prediction and effectiveness repair constraints, and the operational requirements will be defined for USAREUR airfields.

The approach to the study will be based on overlapping a six-phase 6-year multilaboratory research effort conducted at WES. Phase I is a strike threat analysis; Phase II is damage assessment; Phase III is damage effectiveness analysis; Phase IV is documentation of operational requirements; phase V is evaluation of potential rapid repair materials and procedures; and Phase VI is the solution of immediate problem areas associated with current rapid repair materials and techniques. The information developed from the various phases will be used to develop an updated criterion for bomb damage repair as to extent of damage, time constraints, and requirements necessary for repair. Techniques and materials for repair will also be established.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

1.0010, ARCTIC ANTI-EXPOSURE PROGRAM

C. FINK, Energy Systems Corporation, *111 Lock St., Nashua, New Hampshire* 03060 (DN881190; N62269-077C-0149)

To develop a system to provide aircrews operating in the Antarctic with a means for anti-exposure protection in the event of ditching of a similar emergency situation.

A contract has been let with Energy Systems Corp. (on 25 Mar 77) for the procurement of 5 prototype DAPS (downed airman power source) systems for heating the water circulating in the liquid loop garments. After delivery of the prototypes, a subjective test and evaluation program will be conducted by the Crew Systems Dept. Upon completion of the tests, a letter report will be issued evaluating the system.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0011, AIR POLLUTION ABATEMENT FOR JET ENGINE TEST SYSTEMS

W.P. SULE, U.S. Navy, Air Engineering Center, *Lakehurst Naval Air Station, Lakehurst, New Jersey* 08733 (DN696016; N68335-76-C-1136)

To define technology and develop hardware for the effective control of particulate and gaseous chemical emissions resulting from ground run-up testing of gas turbine engines.

Survey existing technology for the possible application of commercial techniques and conduct R/D efforts in those areas which appear most promising for the test cell problem.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0012, FLOTATION FOR AIRCRAFT TECHNOLOGY (FLOAT) INVESTIGATION

J. RIGSBY, Grumman Corporation, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN881344; N62269-77-C-0277)

The general objective is to provide an automatic flotation system for Navy aircraft. Such systems will be carried on board during peace time operations and shall prevent an aircraft and its attached missiles from sinking to the bottom of the ocean following ditching or inadvertent loss from ship decks. The specific objective of this task is to determine optimum location, mechanization techniques and operational implications for such systems. The advantage to the Navy would be rapid, low-cost recovery of politically sensitive aircraft and warheads. A secondary advantage may be realized by reconditioning recovered high-cost airframe and equipment components of new aircraft. This contract supports work unit DH819.

The F14 aircraft has been selected as the investigation baseline because of its planned long service use. After a final, recommended flotation configuration has been defined, a kit-type demonstration system shall be developed, verified in the laboratory for adequacy and tested for flotation capability with a surplus air frame. This concept shall be directed toward minimum aircraft modification, weight and effect on primary mission capability. The concept will be aimed at usage on several aircraft types.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0013, FORWARD SWEPT WING STUDY

G. SPECHT, Grumman Corporation, Grumman Aerospace, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF140920; F33615-77-C-3134)

Present capability of high-performance aircraft to execute develop high turning rates during hassle at transonic speeds can still be considered limited. The problem receives much current attention and a radical new approach may be needed to provide the solution. One such approach requires the wings to be swept forward as opposed to conventional aft swept arrangement. Until recently this concept suffered from loss of static stability due to wing tip bending. The recent developments in aeroelastic tailoring along with active control capability could overcome the sta-

bility loss and permit full realization of numerous aerodynamic benefits such as drag reduction, maintenance of zero static margin, store placement at the center of gravity. This effort would investigate all aspects of forward swept wing technology to provide design criteria.

Identify aerodynamic changes resulting from forward sweep. Construct missions which can benefit from these changes. Design airplane sized to meet mission requirements. Compare performance with aft swept base line.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0014, FUEL CHARACTER EFFECTS ON CURRENT LOW PRESSURE RATIO CAN-TYPE AIRCRAFT TURBINE COMBUSTION SYSTEMS

C. GLEASON, General Electric Company, *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF460830; F33615-77-C-2042)

To determine the effects of fuel character changes on an existing low pressure ratio, can-type AF combustion system.

Single can combustor rig tests will be performed on a current AF combustion system such as the T56, J57, or J79. Fuel hydrogen content, types of aromatics, volatility, and fuel distillation end point are the parameters to be investigated. Close coordination with TBC will be maintained throughout this program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0015, HYPERMIXING NOZZLE

UNKNOWN, Rockwell International Corp., Aircraft Div, *4300 E. 5TH Ave., Columbus, Ohio* 43216 (DN890027; N00019-77-C-0527)

Design and evaluation of an improved hypermixing nozzle.

Using an existing turbulence kinetic energy computer program the entrainment characteristics of various nozzle configurations will be compared. The nozzle configuration exhibiting the most desirable characteristics will be defined relevant to the arrangement of hypermixing and inside elements. Based on these results a hypermixing nozzle will be designed and experimentally tested.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0016, ADVANCED PILOT DISPLAY CONCEPTS FOR FLIGHT CONTROLS OF AIRCRAFT WITH ADDITIONAL DEGREES OF FREEDOM AND PERFORMANCE CONSTRAINTS

P.J. CLOUGH, U.S. Air Force, Flight Dynamics Lab., *Wright Patt. A.F.B., Dayton, Ohio* 45433 (DF141740)

This work unit supports TPO 3, Flight Control, and major thrust FG 02, Crew Systems Integration. Specifically it addresses the problem area involving how to display information on complex trajectories to be flown with advanced aircraft with six degrees of freedom, without increasing pilot workload beyond tolerable limits. The objective is to develop a set of symbology which will enable pilots to manually control advanced aircraft in all phases of flight. Such a suite of displays can be expected to improve operational capability, reduce training costs and provide a standardized set of displays that can be used on different aircraft. Such a set of displays will enable a military pilot to monitor computer-driven autopilot operation while performing other cockpit tasks, or to take control of the aircraft and complete the mission when the autopilot fails.

Head-up displays, vertical situation displays and horizontal situation displays, currently in operation and being developed for such programs as DAIS, MLS, CCV, DFCS, IFFC and AFTI will be evaluated individually and as members of a display cluster. Evaluation conditions will be varied to include advanced flight control systems, complex navigation tasks, curved approach tasks and weapon deliveries, air-to-air and air-to-surface. Investigators will attempt to develop a common display suite which is capable of providing a pilot with all information needed to perform any of the tasks. Human factors guidelines of simplicity and positive transfer will be followed. Promising candidate suites will be programmed for simulator verification and comparison.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, DYNAMICS ENVIRONMENT ON CURRENT AND FUTURE AF FLIGHT VEHICLES

D.E. SEELY, U.S. Air Force, Flight Dynamics Lab., *Wright Patt. A.F.B., Dayton, Ohio* 45433 (DF138010)

To define the dynamics environment existing on current and future AF flight vehicles during flight and ground operation. There is little or no angular vibration data available and insufficient linear vibration and acoustic data available on 'state-of-the-art' flight vehicles to guide design engineers as to the environment that the airframe, electronic, and electrooptical systems will be subjected to. The objective of this work unit will be to measure and record the angular and linear vibration and noise throughout the airframe to determine the magnitude and source of vibration and acoustic energy generated in the aircraft. The data obtained will be used to (1) solve operational problems, (2) update military standards and test specifications, (3) improve system reliability, (4) improve combat effectiveness, and (5) enhance flight safety.

A request 'PID' for an F-111 testbed aircraft has been submitted to ADTC/TGPM on 26 May 76. Another request 'PID' is being submitted to Edwards AFB Flight Test Center for an F-15 testbed aircraft. FBG has an instrumented RF-4C testbed aircraft at ADTC. When the F-111 and F-15 are available, they will be instrumented with suitable accelerometers and microphones, signal conditioning equipment and magnetic tape recorders. Flight tests will be performed at Eglin AFB and at Edwards AFB.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, F100 COMPOSITE REINFORCED BLADE ANALYSIS

T.G. SHROYER, U.S. Air Force, Aeropropulsion Laboratory, *Wright Patt. A.F.B., Dayton, Ohio* 45433 (DF461790)

The objective of this program is to demonstrate the application of composite inlay technology to move the F100 first stage trailing-edge shrouded fan blade flutter boundary out of the engine operating range.

Phase I will use Ti811 material properties to study the F100 blade alone response, blade/disk coupling effects, and no-shroud frequency impact ply orientation and nodal diameter effects will also be examined. Phase II will iterate the above analysis using Ti64 material properties.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0019, AIRCRAFT FORCE MANAGEMENT METHODS

L.E. CLAY, Univ. of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45409 (DF140570; F33615-77-C-3122)

MIL-STD-1530 requires airframe contractors to provide USAF with a force management data package which includes the procedures and techniques necessary to maintain aircraft structural integrity. To date, the elements involved in managing a force of aircraft to protect structural integrity have not been adequately developed. This procurement will support MIL-STD-1530 by developing the necessary force management methodology, including individual aircraft tracking, operational usage monitoring, and maintenance forecasting. The results of this program will be used to establish efficient force management techniques and procedures, thereby reducing costs and maintaining structural integrity of USAF aircraft systems.

This effort will include the development of methodologies for the various elements involved in force management. Necessary complexity and duration will be determined for usage monitoring programs to be used for developing base line operational spectra and detecting significant changes in usage. Individual aircraft tracking techniques will be developed which are realistic compromises between ideal tracking programs and economic/logistic constraints. Optimum procedures for forecasting maintenance actions will be established.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, FLOTATION FOR AIRCRAFT, TECHNOLOGY (FLOAT) INVESTIGATION
W.M. WEISEMANN, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN881113)

The general objective is to provide an automatic flotation system for Navy aircraft. Such systems will be carried on-board during peacetime operations and shall prevent an aircraft and its attached missiles from sinking to the bottom of the ocean following ditching or inadvertent loss from ship decks. The specific objective of this task is to determine optimum location, mechanization techniques and operational implications for such systems. The advantage to the Navy would be rapid, low-cost recovery of politically sensitive aircraft and warheads. A secondary advantage may be realized by reconditioning recovered high-cost airframe and equipment components of new aircraft. This effort is supported by work unit DH819B.

A contract, using the F-14 as the investigation base line, will be awarded. NavAirDevCen will define general milestones to be followed. After a final, recommended flotation configuration has been defined, a kit type demonstration system shall be developed, verified in the laboratory for adequacy and tested for flotation capability with a surplus airframe. This concept shall be directed toward minimum aircraft modification, weight and effect on primary mission capability. The concept will be aimed at usage on several aircraft types.

SUPPORTED BY U.S. Dept. of Defense, Navy

1.0021, A/C MOTION SENSITIVITY STUDY
T.F. LANGHAM, Arnold Research Org. Inc., *Tullahoma, Tennessee* 37389 (DF421051; F40600-77-C-0003)

To study the importance of dynamic cross and cross-coupling derivatives in aircraft motion simulation.

The maneuvering flight characteristics of three aircraft will be analyzed using the 6-DOF aircraft stability program. Sensitivity of aircraft motion to various cross and cross-coupling derivatives will be examined by varying these derivatives over ranges surrounding nominal values.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Arnold Engineering & Development Center

1.0022, SYSTEMS ANALYSIS FOR ESTIMATING THE CAPACITY OF AN AIRPORT
B.F. MCCULLOUGH, Univ. of Texas, School of Engineering, Civil Engin, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: In recent years airport terminals across the United States have experienced considerable congestion in moving passengers and baggage. This has resulted in long queues and excessive delay in such areas as the boarding lounge, baggage retrieval, ticket lines, etc. One of the key reasons for this rapidly developing congestion is that airport terminals have not always been designed as a system. Primarily, each of the component parts are designed individually without taking into account their interrelationship. The need has become apparent in the past few years for an analytical model capable of analyzing the flow in a passenger terminal and also the parking lots.

Considering this background, the following project objectives are stated: (1) Observe and collect data as to the flow of passengers and baggage in a terminal. (2) Develop a systems model that is capable of use for designing new terminals and analyzing existing terminals. (3) The models should be capable of predicting the level of service for different flow rates.

ADDENDA: This project is also supported by: Council for Advanced Transportation Studies.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0023, PROPULSION-INDUCED AERODYNAMICS OF V/STOL IN TRANSITION/STO
T.D. BEATTY, Vought Corporation, *P.O. Box 5907, Dallas, Texas* 75222 (DN881372; N62269-78-C-0036)

Development of a methodology for prediction of propulsion-induced aerodynamics of multi-jet V/STOL aircraft in the transition/STO flight regime.

Advanced development of computerized prediction technique for V/STOL aerodynamics will be accomplished. An improved vortex and entrainment jet flow model will be incorporated together with a method to account for jet wake separation. An image system for ground effect will be modified to permit calculations throughout the STO flight regime including the effects of jet impingement on the ground. Correlation of predictions with experimental data will be accomplished for representative V/STOL configurations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0024, AIDS AIRCRAFT INTEGRATION (A-7)
P. GREER, Vought Corporation, Vought Aeronautics, *P.O. Box 5907, Dallas, Texas* 75222 (DN881141; N62269-77-R-0186)

To provide inputs to aid in the development of the AIDS (Advanced Integrated Display System). The AIDS program objective is to develop a totally new concept in modular cockpit instrumentation for naval air missions under all operational conditions, accomodating all aircraft sensors, and satisfying 1980 era requirements for dependability and supportability. This contract supports work unit ZA601, Agency Accession No. DN681080.

The contractor will examine the AIDS concepts in relation to a particular existing aircraft (A-7E) manufactured by Vought and project this evaluation to a future tactical aircraft such as is envisioned by Vought.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0025, AEROELASTIC STABILITY AND PERFORMANCE CHARACTERISTICS OF AIRCRAFT WITH ADVANCED COMPOSITE SWEPT FORWARD WING STRUCTURES
T.A. WEISSHAAR, Virginia Poly. Inst. & St. U., School of Engineering, Aerospace & Ocean Engineering, *Burruss Hall, Blacksburg, Virginia* 24061 (DF141460; AF-AFOSR-3423-77)

Preliminary studies indicate that aircraft with forward swept wings show improvements in transonic performance when compared to conventional aircraft. Sweeping conventional metal wings forward decreases aeroelastic divergence speed but by using aeroelastic tailoring with advanced composites the forward swept wing can be designed divergence-free. The Defense Advanced Research Projects Agency is sponsoring a program with AFFDL as its agent to study aircraft with forward swept wings. As part of this program, the Virginia Polytechnic Institute (VPI) will study forward swept wings constructed with advanced composites to determine the aeroelastic benefits of these wings. The work began 1 Sept. 77 and will be monitored as part of this work unit.

The VPI program is a six-month study concerning the effect of three aeroelastic problems in the use of advanced composites on forward swept wings - aspect ratio, static stability and trim, and maneuvering loads. Particular attention will be given to the assessment of the different types of composite materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, WIND TUNNEL EVALUATION OF AN AEROELASTICALLY CONFORMABLE ROTOR
R.P. WHITE, Systems Research Labs. Inc., R A S A Division, *1055 J. Clyde Morris Blvd., Newport News, Virginia* 23602 (DA0E3777; DAAJ02-77-C-0046)

Investigate the ability to improve rotor operational qualities (i.e., performance, efficiency, loads, stability and handling qualities) by deliberately designing aeroelastic properties to exploit the inherent tendency for blades to deform elastically. Determine if significant practical improvement can be made in rotor operational qualities reliability and maintainability, and cost. This effort will be directed toward generation of advanced data pertinent to advanced Army aircraft, including UTTAS, AAH, and ASH.

Conduct thorough review of effects of aeroelastic properties on rotor operational qualities. Select specific significant parameters and objectives which can be evaluated with existing technological capability. Perform rigorous phenomenological stu-

dies of the results of parameter variations using advanced analytical tools. Design and fabricate wind tunnel models, and perform comprehensive tests to substantiate analytical findings. Carefully review results to determine specific parametric trends for improving rotor design. Where practical, interpret trends in terms of full-scale design characteristics which may be applied in aircraft development.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Air Mobility Research & Development Lab.

1.0027, HT PP 78-07 - EVALUATION OF THE BENEFITS OF USING THE PRESSURIZED AIR START SYSTEM (PASS) FOR ARMY HELICOPTERS

P. CHESSER, U.S. Army, Applied Technology Laboratory, *Fort Eustis, Newport News, Virginia* 23604 (DA0E3810)

The objective of the program is to determine the benefits of using the PASS on other future Army helicopters.

Current propulsion engine start systems will be analyzed relative to cost, weight, and R & M to establish a base line for comparison with the PASS. Utilizing the results of an 'Evaluation of Pressurized Air Start System for Advanced Army Helicopters (6000-7000 pound GW)' conducted by AiResearch under contract DAAJ02-77-C-0007, a comparison will be made to determine the benefits of using the PASS.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0028, HT RM 78-20 - ENVIRONMENTAL DESIGN AND TEST GUIDE FOR ARMY HELICOPTERS

UNKNOWN, U.S. Army, Applied Technology Laboratory, *Fort Eustis, Newport News, Virginia* 23604 (DA0E3828)

The objective of this effort will be to develop an environmental design and test guide for Army helicopters based on the previous work performed by Rockwell International. The guide will be used to assist Army planners in the establishment of design and test criteria for future Army aircraft programs. This document will also be used by industry personnel to assist them in the design and test of their vehicles to meet environmental requirements.

Using the services of the Earth Sciences Laboratory, Ft Belvoir, VA, the combined and accelerated environmental design and test criteria and procedures will be developed where practical or a method developed to establish those criteria and procedures when it is not practical to establish generalized criteria and/or procedures. The previous work by Rockwell and this work will then be combined and a design and test guide prepared.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, OPTIMAL ATTITUDE CONTROL OF FLEXIBLE SATELLITES

K.T. ALFRIEND, U.S. Navy, Res. Laboratory, *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680434)

The objective of this program is the development of methods for the optimal and sub-optimal attitude control of flexible satellites.

The initial step is the implementation of the satellite flexibility into the control problem. This will be accomplished by investigating the various methods for modeling the flexibility to see how they can be included in the control problem. Five various classical satellite problems will then be considered to compare methods of minimizing flexible body motion. Finally, general methods will be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, MOLECULAR BEAM ELECTRIC RESONANCE SPECTROSCOPY OF IONIC MOLECULAR COMPLEXES

J.S. WINN, Univ. of California, School of Letters & Science, Chemistry, *Berkeley, California* 94720 (CHE77-21915)

The equilibrium intermolecular potential between two molecules or an atom and a molecule, one of which (or both) contains a highly ionic bond will be investigated by the molecular beam electric resonance spectroscopy of molecular complexes bound by such an intermolecular potential. The alkali halide dimers, the argon-alkali halide triatomics, the alkali metal triatomics, the argon-dialkali triatomics, and the chemically bound noble gas dihalides will be the species of primary interest during these studies. These species will be formed in a supersonic molecular beam and detected by both positive and negative ion mass spectroscopy, utilizing the phenomenon of dissociative electron attachment to molecular clusters to generate the negative ions. Electric resonance spectroscopy will be performed in the microwave and radio frequency regions. Theoretical calculations which indicate the types of structures expected in these studies, and additional calculations of ionic molecular complexes will be performed during the course of this work.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0002, ADVANCED HYDROCARBON FUEL DEVELOPMENT

R.N. HAZLETT, U.S. Navy, Res. Laboratory, *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN796896; WR00022)

To give a chemical to the complex oxidative and pyrolytic degradation reactions of jet aircraft fuels which give undesirable products such as varnishes and gums in fuel system components. Developments arising from these efforts will aid in defining jet fuel composition and suggesting alternate fuel-handling procedures and materials for fuel system components.

The chemical reactions of jet aircraft fuels and hydrocarbon components are being studied in a flowing system which simulates the heat stress in an advanced aircraft fuel system. The main effort is for exposures associated with short times, high temperature (500-1000 F), and air saturated fuels. The overall chemical reaction schemes are being examined so that critical oxidative and pyrolytic reactions can be identified and altered. The elemental composition of deposits formed in various devices is also being utilized to define the important fuel reactions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

3.0003, NAVAL VEHICLE TECHNOLOGY - STRUCTURAL MECHANICS OF COMPOSITES AND BONDED JOINTS FOR NAVAL VEHICLES

P. MAST, U.S. Navy, Res. Laboratory, *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN820013)

Develop more efficient, automated, methods for the mechanical characterization of orthotropic and viscoelastic materials such as fiber-reinforced composites and adhesives, and for the design of structural components using these materials. This will permit more effective utilization of those materials and increased reliability in naval structures such as ships, underwater vehicles, missiles, and aircraft.

Develop a large base of experimental data, obtained under complex loads to simulate service conditions, to describe the failure behavior of the material. Develop and apply analytical techniques to express the data obtained as failure criteria. Integrate these criteria with computer-based structural analysis programs in an automated design process.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

3.0004, EXTENDED KOOPMANS' THEOREM AND ITS APPLICATION TO QUANTUM CHEMISTRY

D.W. SMITH, Univ. of Georgia, Graduate School, Chemistry, *Athens, Georgia* 30601 (CHE75-02353 A02)

Dr. Smith intends to continue a program of research currently supported by Foundation grant, GP-34497X. Koopmans' Theorem in its original formulation states that in the independent particle scheme, the energy to remove an electron from an atom or molecule is equal to the energy of the orbital which the electron occupied. These energies must be calculated by the self-consistent-field method to be physically significant. Dr. Smith plans to investigate an extension of this theorem through calculations of ionization potentials and through development of the mathematical and conceptual basis of the extended theorem. While the original theorem has been widely used in chemistry and electron physics, and is so basic to chemical and physical thinking that it is implied in most discussions of electron loss, capture, and excitation, there are two major drawbacks to the use of the theorem. First, it assumes a self-consistent (independent-particle) approximation for the parent atom or molecule undergoing ionization, and therefore ignores correlation effects. Second, it does not allow for rearrangement of the other electrons when one is removed. His extended theorem corrects for these two deficiencies in such a way as to give extremely accurate predictions of valence electron ionization energies in preliminary studies so far, on 4-electron systems. He plans to study additional systems such as the Li and Ne atoms and the N2 molecule, and to investigate the properties of the new effective single-particle potential which comes out of the theory.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0005, MATERIALS SUPPORT TECHNOLOGY - HYDROGEN IN AND ON METALS

C.P. FLYNN, Univ. of Illinois, School of Liberal Arts & Sci., Physics, *Urbana, Illinois* 61801 (DN475364; N00014-75-C-0918)

This contract contributes to the materials support technology concerned with hydrogen embrittlement of metals and the understanding of chemical catalysis.

The contractor will use ultraviolet absorption and magneto-optic measurements to study hydrogen dissolved in and absorbed on metallic hosts.

ADDENDA: Supporting agency address is: Office of Naval Research 421, Arlington, VA. 22217

SUPPORTED BY U.S. Dept. of Defense, Navy

3.0006, A THEORETICAL INVESTIGATION OF SPECTRAL LINE SHAPES - SATELLITE BANDS, PERTURBER-PERTURBER INTERACTIONS, AND NON-SCALAR INTERACTIONS

K.M. SANDO, Univ. of Iowa, School of Liberal Arts, Chemistry, *Jessup Hall, Iowa City, Iowa* 52240 (CHE76-11968 A02)

A theoretical investigation of aspects of atomic line shape theory is planned. Applications will be made to line shapes for alkali metal atoms perturbed by rare gases and to radiative processes important in Laser systems. Semiclassical theory, molecular dynamics simulation, and quantum close-coupling calculations will be used to study the properties of satellite bands, the accuracy of the independent perturber approximation, and the accuracy of the scalar potential approximation.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0007, INVESTIGATION OF MECHANISMS AFFECTING ENVIRONMENTAL STRESS CRACKING IN TITANIUM ALLOYS

I.J. GRAHAM, Southern Univ. A & M College, School of Engineering, Mech Engin, *Baton Rouge, Louisiana* 70813 (DN890058; N00019-78-C-0065)

Program to investigate mechanisms affecting environmental stress cracking in titanium alloys.

Use the fracture mechanics approach with the application of acoustic emission test techniques to predict the useful life of a structure subjected to sustained and/or cyclic loads under certain controlled environments at designed temperatures and pressures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0008, MICROSTRUCTURE OF AMORPHOUS AND SEMI-CRYSTALLINE POLYMERS

D.R. UHLMANN, Mass. Inst. of Technology, School of Engineering, Metallurgical & Materials Sci, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF046980; AF-AFOSR-3226-77)

AF function - advanced aircraft systems will utilize lightweight polymeric and adhesively bonded structural components and composites and impact-resistant transparent canopy materials. Deficiency - although the mechanical and optical properties are determined by processing, the fundamental understanding governing behavior is inadequate. Objective -selected microstructural features of amorphous and semi-crystalline polymers and their relation to processing and mechanical, physical and optical properties will be investigated. How work contributes - this research will help develop the understanding regarding the character of supramolecular structure and the importance of specific morphological features in determining properties which are needed for processing matrix and adhesive resins whose chemistry and microstructure can reproducibly be tailored to specific needs.

The study will explore (1) nodular structures in amorphous thermosetting and thermoplastic polymers (2) chemical and structural differences between bulk material and near-surface regions in semi-crystalline polymers (3) crystallization behavior under high thermal gradients and its effect on structure and (4) differentiation between adjacent reentry folding and switchboard models for the basic structural units in semi-crystalline polymers. In each case a combination of experimental techniques will be used to elucidate the important structural features of the materials and their variations with changes in process conditions. The structural features will in turn be related to the mechanical and optical properties of the materials with specific attention directed to yield and fracture behavior and to transparency at optical frequencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0009, QUALITY CONTROL OF STRUCTURAL NON-METALLICS

J. CARPENTER, McDonnell Douglas Corporation, *P.O. Box 516, St. Louis, Missouri* 63166 (DN790043; N00019-77-C-0155)

(a) Determine relationships between chemical composition and the mechanical properties and processability of the 3501-6 resin system proposed for the F-18 aircraft; (b) concurrently with (a) develop advanced methods for chemical analysis and characterization of composite prepreg resin system; (c) evaluate the correlative relationship determined between chemical composition and the mechanical properties and processability of 3501.

The resin manufacturer will prepare special batches, each one with a particular modification in chemical composition. Each batch will be advanced in cure to a predetermined degree and will submit the materials to McDonnell Aircraft Company. McDonnell personnel will analyze the different batches chemically to verify their composition. Then, with test procedures developed under the program, evaluate and characterize their performance as composite prepreg resin systems. Finally, the contractor will determine the correlative relationship between chemical composition and processability of the best formulation with mechanical properties.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0010, MECHANICAL INTERFACE SPLINE DEVELOPMENT

P.B. SENHOLZI, U.S. Navy, Air Engineering Center, *Lakehurst Naval Air Station, Lakehurst, New Jersey* 08733 (DN896011)

To develop new design concepts for aircraft dry splines in order to reduce wea..

The approach is this effort will consider lubricants as well as contaminants, materials, surface characteristics, and design. Variations of these factors will be tested on pump splines. Test results shall define an optimal set of variables based on spline wear rate.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0011, NUCLEAR MICROPROBE HYDROGEN DETECTION TECHNIQUE

P. ADLER, Grumman Corporation, Aerospace Corp, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN590052; N00019-75-C-0394)

To provide direct experimental evidence on whether hydrogen, which is known to play a role in premature brittle failure of high-strength steel and titanium alloys, is also involved in the intergranular failure characteristic of high-strength aluminum alloys under stress-corrosion conditions. Establish hydrogen sensitivity and depth limitations associated with interferences from LMN induced reactions in other elements and establishing LMN detection limits associated with low-level hydrogen concentrations in material surfaces.

Hydrogen depth profile analysis utilizing the lithium nuclear microprobe will be conducted in the vicinity of interfaces, prepared to represent grain boundaries of aluminum alloys, after exposure to sustained loads in a corrosive environment. In addition, preliminary materials analysis experiments will be continued to help elucidate the direction of future materials research efforts related to the influence of hydrogen in brittle fracture.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0012, ELASTIC-PLASTIC DEFORMATION IN CRACKED SOLIDS AND DUCTILE CRITERION 15226-E

H.W. LIU, Syracuse University, School of Engineering, Chemical Engin & Metallurgy, *Link Hall, Syracuse, New York* 13210 (DA0F9176; DAAG29-78-G-0069)

To develop a ductile fracture criterion and a rational testing procedure for fracture toughness measurements. Relevance - this research is important in the analysis and design of Army structures and materiel particularly since lightweight, ductile and tough materials are needed for helicopter and lightweight armor.

An experimental and numerical analysis on crack tip deformation and crack tip stresses will be carried out on bending and tension specimens.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0013, MATERIALS SUPPORT TECHNOLOGY - SURFACE REACTIONS

J.B. HUDSON, Rensselaer Polytechnic Inst., School of Engineering, Materials Engineering, *110 8TH St., Troy, New York* 12181 (DN223360; N00014-75-C-0730)

Reactions at surfaces are important in many areas of interest to the Navy which include corrosion processes, catalytic processes, and reactions which affect the electrical properties of semiconducting devices. It is the purpose of this research to investigate reactions at surfaces with a view toward improving the properties of Navy material subjected to harsh environments.

The stoichiometry, steric configuration, and electronic structure of adsorbed species participating in surface reactions are being characterized by analyzing the particles emitted when the adsorbed species are bombarded by low energy electrons. Information is being obtained concerning the binding energy of the adsorbed species to the surface, surface coverage by the adsorbed species, and the nature of adsorbed intermediates formed by reactions on the surface.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0014, LASER SPECTROSCOPY OF GASEOUS IONS AND MOLECULES

R.A. BERNHEIM, Penn. State University, School of Science, Chemistry, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (CHE77-08326 A01)

Dr. Bernheim plans to continue and expand a program of research currently supported by Foundation grant CHE-7520122. He will use high resolution laser spectroscopy to study a number of molecular species including gaseous molecular ions. The spectroscopy will be performed using two dye laser systems: a nitrogen laser pumped dye laser which employs laser amplifier stages for high power and an external etalon filter and is tuned by the variation of pressure of the gas at all etalon and grating interfaces, and a CW dye laser stabilized by having its frequency locked to an external reference etalon. Measurements on methylene, CH2, will yield values of the bond angle and spin interactions in the triplet ground state. Studies of the first excited electronic state of LiH and LiD will concentrate on measurements of the electric dipole moment as a function of vibrational quantum number to verify the unusual theoretical predictions concerning its behavior. In addition, he will concentrate on an area of molecular spectroscopy which still remains in its infancy, that of gaseous molecular ions. In this work he plans, in addition to a 'traditional' laser excitation approach, to use the high sensitivity of mass spectrometric detection to perform the spectroscopy by, for example, carrying out a stepwise excitation first to the state to be measured and then to the continuum where photodissociation can occur.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0015, NAVY VEHICLE DESIGN AND CONSTRUCTION - ORIENTED POLYMERS

J.L. WHITE, Univ. of Tennessee, School of Engineering, Chemical & Metallurgical Engin, *W. Cumberland Ave. S.W., Knoxville, Tennessee* 37916 (DN775285; N00014-77-C-0236)

New polymeric compositions of high strength are of interest to the Navy for improved lightweight composites because lightweight organic structural materials can provide much improved payload/weight ratios in aircraft and surface effect ships. The proposed research will provide new materials and theoretical models to meet Navy needs in this area.

This work will be directed toward the preparation of biaxially oriented aromatic polyamide films from liquid crystalline polymer solutions. Experiments will be carried out to determine whether the successful one-dimensional approach utilized for fiber spinning can be extended to other shapes and structures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0016, REAL-TIME DAMAGE MODES IN CARBON-CARBON COMPOSITE MATERIALS

P.H. FRANCIS, Southwest Research Institute, *8500 Culebra Rd., San Antonio, Texas* 78228 (DN775516; N00014-77-C-0510)

Carbon-carbon materials are used in propulsion and reentry components of advanced strategic systems. Failure modes and mechanical properties are significantly affected by initial defect and flaw distributions and subsequent progressive damage under load. Significant damage (beyond the initial damage) can occur throughout the part under load before failure occurs. This research program will identify damage modes/mechanisms and subsequent constituent failure.

Well-characterized carbon-carbon materials test specimens will be evaluated and observed under load in a scanning electron microscope. Real-time damage and crack growth will be observed. Damage mechanisms and sequential damage modes will be identified throughout the test specimens. Billets of 2-2-3 weaves, 3-D Cartesian material with 60 mil fiber spacing, density of 1.80 are to be cut and distributed to other contractors.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0017, PARTIAL-WAVE METHODS IN MOLECULAR ELECTRONIC STRUCTURE CALCULATIONS
E.A. MCCULLOUGH, Utah Higher Education System, School of Science, Chemistry & Biochemistry, *Main Bldg., Office 104, Logan, Utah* 84321 (CHE76-08768)

One goal of molecular quantum mechanics research is the quantitative prediction of molecular properties. In light of contemporary scientific problems involving molecules in the upper atmosphere or interstellar space, this goal increases greatly in importance, for the molecular species found in these environments are difficult to study by experimental methods. Hence, theory can and must make significant contributions in these areas. Despite recent advances in molecular quantum mechanics, there remains a group of molecular properties which are difficult to compute accurately. This is because most of the current techniques rely on a single computational method which is not well suited to the description of these properties. Recently, a new method involving partial-wave expansions and numerical orbitals has been developed. The method has been implemented successfully for diatomic molecules and preliminary results have shown that the present method works very well at the first level of approximation (restricted Hartree-Fock). The present research project will extend this new method to higher levels of approximation in order to fully develop this method of computing accurate molecular properties.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, AERO DESIGN, SIMULATION AND DATA INVESTIGATION OF DEMO ROCKET
J.W. WALLACE, U.S. Army, Aeroballistics Directorate, *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G1014)

To improve the accuracy and reduce the cost of surface-to-surface free flight rockets through aerodynamic techniques.

The aerodynamic configuration design will be established for the demonstration low cost motor vehicle. Work will include wind tunnel tests, final configuration, and related aerodynamic coefficients. Simulations will be conducted using existing rigid body six degree-of-freedom trajectory digital simulation programs which will be modified to include particulars of the demo rocket. Flight data investigations support will be provided to the free flight rocket technology program for the determination of aerodynamic coefficients and exterior ballistic performance.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Free Flight Rocket Technical Office

4.0002, POWER CONDITIONER UNIT
L. HODGES, Delta Electronic Control Corp., *1701 Pomona Ave., Costa Mesa, California* 92627 (DN781392; N62269-76-C-0224)

To develop a power conditioner unit to provide the aircraft electrical requirements of 400 cycle and 28V DC power from the HVDC bus power. This contract supports work unit ZA601, Agency Accession No. DN681080.

To design the power conditioner unit utilizing advanced solid-state design techniques to provide with improved performance characteristics.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0003, TRANSDUCERS AND ACCELEROMETER FOR FLIGHT LOADS
A. ORLACHIO, Golton Industries, *1644 Whittier Ave., Costa Mesa, California* 92627 (DN781218; N62269-76-C-0164)

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0004, DEVELOPMENT AND EVALUATION OF ADVANCED PARACHUTE CANOPY DESIGNS
J.D. BOONE, U.S. Navy, Natl. Parachute Test Range, *El Centro, California* 92243 (DN937028)

To improve consistency of parachute canopy operation, simplify manufacturing procedures, improve quality control, reduce opening shock loads, reduce weight and bulk and improve operational envelope as a result of basic design capability. More specifically, a parachute canopy consisting of much less than the approx. 130 pieces in the present 28-ft flat canopy; reduction in operating forces by use of variable porosity and energy absorbing materials; maintain, as a minimum, the present capabilities; reduce weight and bulk by 20%.

Bulk and weight to be reduced by use of wider fabric and new design and construction to reduce number of seams and reinforcing tapes. New materials to be used where same performance can be obtained with weight and bulk savings. Energy absorbers (peak load limiters) to be used to reduce strength requirements and therefore weight and bulk.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0005, MULTIPHOTON GAS PHASE SPECTROSCOPY
J.E. WESSEL, Univ. of Southern California, Graduate School, *3551 University Ave., Los Angeles, California* 90007 (DF049970; AF-AFOSR-3438-77)

AF function - operations in surveillance, detection and communications require knowledge of physical phenomena and techniques underlying electrooptical devices using coherent light and the various spectral regions. Deficiency - a need exists for techniques to investigate atmospheric gases, chemical processes, and radiation effects to enhance the above functions. Objective - the establishment of a multiphoton electronic spectroscopy capability to overcome the limitations of the selectivity of optical excitations, detection methods, and the various spectral complexities in large molecules. How work contributes - results in this study will yield information on trace vapor detection and in the related fields of molecular electronic laser development, selective photochemistry and ultraviolet laser propagation.

Three types of experimental investigation are being undertaken which include the following - (1) resonance enhanced two photon absorption, (2) resonance enhanced multiphoton photoionization, and (3) influence of coherence on these, (1), (2), processes. In the two-photon absorption experiment the molecule selected (azulene) for the initial study will have an allowed excited state singlet transition. Absorption will be detected by measuring the fluorescence. In addition, a molecule with a non-fluorescent final state will be studied using photoacoustic detection. The three-photon-photoionization study will consist of a range of molecules to determine if the method is generally applicable. The relevant effects of coherence of excitation upon multiphoton detection will also be explored.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, OPTICAL MICROWAVE DEVICES
M.K. BARNOSKI, Hughes Aircraft Company, Research Laboratory, *3011 S. Malibu Canyon Rd., Malibu, California* 90265 (DN780176)

To investigate the control of solid-state microwave devices using light injection. The interaction on light with semiconductor devices will be investigated and use will be made of optically induced carriers to initiate, control or quench device operation. Injection phase locking will be one of the first goals to be pursued. Several oscillators will be phase locked to a master oscillator using light injection. The required tasks include: (1) investigate optical/carrier processes in semiconductor devices and determine their role on device performance; (2) design and fabricate hybrid optical/microwave structures using discrete components; and (3) investigate microwave modulation of injection lasers for use in hybrid packages. The Navy has a continuing requirement for new and/or improved capabilities in its various microwave systems.

Microwave modulation of injection lasers will be investigated. depth of modulation, modulation power and waveform characteristics will be determined as a function of

frequency. 4 gHz operation will represent the goal of the first phases. Using injection lasers and fiber optics, light injection into semiconductor devices will be investigated. FET/S, IMPATTS and bipolars will be representative devices used in this study. Phase locking using microwave modulated light will be investigated and characterized. Fast switching of solid-state microwave devices using light injection will also be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0007, THIN FILM INDIUM PHOSPHIDE (INP)/CADMIUM SULFIDE (CDS) TERRESTRIAL SOLAR CELLS

L.M. FRAAS, Hughes Aircraft Company, Research Laboratories, *3011 S. Malibu Canyon Rd., Malibu, California* 90265 (E(29-2)-3717)

The objective of this contract is to fabricate and evaluate an all thin-film indium phosphide (InP)/cadmium sulfide (CdS) terrestrial solar cell which will: (1) maximize light-generated carrier collection across heterojunction; (2) minimize leakage current arising via grain boundary leakage and interface imperfection-assisted tunneling; and (3) optimize sheet resistance and minimize contact resistance. In performance of this objective the contractor shall: (1) incorporate a Knudsen cell into the planar reactive deposition epitaxy system; (2) incorporate a doping scheme into the deposition procedure to attain P-type InP thin films; (3) undertake the epitaxial deposition of InP on single crystals of CdS of different orientation; (4) optimize the properties of the recrystallized CdS substrate to minimize leakage current; (5) fabricate all thin-film InP/CdS solar cells; (6) evaluate single crystal and thin-film InP/CdS cells by electron diffraction, quantum efficiency and solar efficiency measurements; (7) reevaluate and optimize the InP/CdS solar cell design parameters in a manner aimed at the production and deployment of high efficiency photovoltaic solar cells capable of being scaled to an annual production of 50,000 mW/year by the year 2000 at selling price of $100 to $200/peak kW without creating inordinate technical and economic problems. (ERDA-76-161)

SUPPORTED BY U.S. Dept. of Energy, Div. of Solar Technology

4.0008, NON-INTERFERENCE LASER-BASED DIAGNOSTIC TECHNIQUES APPLIED TO TURBULENT COMBUSTION DYNAMIC PHENOMENA

R.K. HANSON, Stanford University, School of Engineering, Mech Engin, *Palo Alto, California* 94305 (DF051150; F49620-78-C-0026)

AF function - advanced diagnostic techniques, advanced air-breathing engines, weapon delivery and defense. Deficiency - inability to obtain reliable measurement of important parameters in turbulent reacting flows in practical hostile combustion environment via present day measuring and diagnostic techniques, inability to reliably evaluate combustion models. Objective - to develop more sensitive selective, precise, reliable and rapid diagnostic methods for measuring important parameters in jet engine reacting flow environment. To determine feasibility of using tunable diode laser and other laser-based diagnostic techniques for obtaining reaction kinetic-turbulence coupling effects, fundamental combustion gas spectroscopic parameters and high spatial and time resolution temperature species concentration and velocity measurements in practical combustion environments, to determine capabilities and limitations of these techniques as laboratory diagnostic tools, to provide reliable experimental data to the combustion modeler. How work contributes - will provide additional understanding and reliable data to permit realistic evaluation of analytic models of complex reacting flows, will help reduce development time and cost of air-breathing propulsion systems, will permit evaluation of capabilities and limitations of various diagnostic methods, will aid in development of improved or novel new in situ nondisturbing techniques for accurately measuring turbulent reacting flow parameters.

Tunable diode laser techniques for species concentration and temperature measurements under steady and fluctuating combustion conditions will be developed and applied. Experiments will be conducted in flat-flame burner. Alternative schemes for laser modulation and data-handling will be evaluated in order to optimize the experimental technique, particularly with regard to minimizing the time required to complete the measurement. In addition, coupling between fluid dynamics and reaction kinetics in a two-dimensional turbulent reacting shear layer will be studied. Advanced laser diagnostics, including tunable diode lasers and laser anemometry, will be employed to characterize the flow field structure. The experimental data will be used to determine the influence of fluid dynamics on reaction rates. To extend existing combustion diagnostic capabilities, several point-measuring schemes will be evaluated, including fluorescence. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, PRODUCTIVE USES OF AEROELASTICITY RESULTING FROM UNSTEADY FLOW PHENOMENA

A. HOLT, Stanford University, Graduate School, *Palo Alto, California* 94305 (DF140160; AF-AFOSR-3263-77)

This work unit supports the evaluation of the aeroelastic response of aircraft structural components. It will contribute to the development of improved unsteady aerodynamic methods to predict aircraft aeroelastic stability and structural dynamic response. The goal is to conduct theoretical studies and unsteady aerodynamic tests for oscillating airfoils in subsonic wind tunnels, resulting in ultimate savings in design and cost of new aircraft and improved performance. The orderly development of analytical methods coupled with the capability to make experimental measurements of cyclic airfoil motion will contribute to the design of aircraft for minimum weight and cost.

The proposed effort will include a theoretical investigation of the response of airfoils under cyclic motion, assembly and development of methods for evaluating the aeroelastic properties of composite configurations, of unsteady aerodynamic phenomena associated with flight propulsion, and experimental measurement of chordwise aerodynamic forces during flapping and pitching motion. The objective is to measure and categorize the phenomena associated with oscillating airfoils in an attempt to identify an aerodynamic cycle that results in net lift and thrust.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0010, D-REGION PROFILE STUDY

UNKNOWN, Pacific Sierra Research Corp., *Santa Monica, California* 90404 (DF903000; F19628-77-C-0231)

AF function - command/control/communications. Deficiency -ionospheric models for use in VLF/LF propagation prediction codes. Objective - to determine the applicability of d-region models deduced from steep incidence ionosounder data to long-range VLF/LF propagation prediction codes. How research contributes - the research will determine the validity of using d-region models determined from short path ionosounder measurements in long range VLF/LF propagation programs.

The contractor will study the relationship of d-region reflection properties at steep incidence to those at grazing incidence for a wide range of VLF/LF frequencies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0011, OPTICAL ELECTRONIC TRANSDUCERS

R.J. PHELAN, U.S. Dept. of Commerce, Natl. Bureau of Standards, *325 S. Broadway, Boulder, Colorado* 80302 (2764152)

PROJECT OBJECTIVE: Conceive, develop and evaluate electrooptic devices to advance the resolution, accuracy and capabilities of electro-magnetic radiation measurements. Develop and prove MOM diodes for higher electromagnetic frequency measurements. Develop and prove a Josephson junction sampling oscilloscope (JJSO) for shorter time resolutions. Create and demonstrate 1.3 micron, ultrafast infrared emitters, detectors and modulators with Si-Ge alloys for fiber optic measurements.

PROJECT APPROACH: Develop the solid-state theoretical base for specific new device concepts; create required structures using the micron dimensional capabilities of the device fabrica-

tion facility; using the current technologies of electromagnetics, modern optics and cryogenics evaluate concepts; publish results in professional journals, and transfer results to other laboratories and industries.

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

4.0012, DESIGN AND PROTOTYPE FABRICATION OF A CURRENT-TECHNOLOGY FLYWHEEL-ELECTRIC VEHICLE

D.D. RATCLIFF, U.S. Air Force, Electrical Engineering Dept., *A.F. Acad., Colorado Springs, Colorado* 80840 (DF282230)

AF function - technology base with near-term benefit to mission support. Deficiency - motor pool cost for short-range transportation of small numbers of personnel is high due to the high cost of gasoline and the inefficiency of gasoline engines. Current electric vehicles with lead-acid batteries suffer from short range. Objective - this research is to demonstrate the feasibility of a flywheel-electric car with adequate range using current technology and lead-acid batteries. How it contributes - such a vehicle could save some of the cost of motor pool operations and could provide a test bed for more advanced batteries.

A 4-passenger car will be constructed on an existing frame .th a lightweight body. High efficiency will be approached by use of a flywheel-motor subsystem driving the wheels through a continuously variable transmission. Power storage will be in a conventional lead-acid battery array. The transmission will be shifted automatically for efficiency and ease of driving. The baseline data from the vehicle using lead-acid batteries will be used to evaluate present potential for the concept and will provide a basis for comparison if high-technology batteries become available in the next few years.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

4.0013, NEAR-EQUATORIAL PLASMASPHERE

T.H. ROELOFS, Univ. of Hawaii, School of Engineering, Electrical Engin, *Bachman Hall, Honolulu, Hawaii* 96822 (DF580190; F19628-78-C-0050)

AF function - time delay errors produced in satellite navigation and detection systems. Deficiency - present models of ionospheric time delay do not include the contribution of electrons from heights above approximately 1,000-3,000 kilometers, a region called the plasmasphere. In the equatorial anomaly region where the ionospheric time delays are the world's highest the additional contribution to total time delay of the plasmasphere is unknown. Objective - measure the diurnal and seasonal plasmaspheric electron content during magnetically quiet and disturbed conditions. How research contributes - these results will be used to improve existing models and prediction techniques for time delay to operational satellite detection radar and navigation systems, particularly when operating in the Pacific equatorial anomaly region.

The plasmaspheric electron content will be found by making simultaneous measurements from a ground station in Hawaii of the true group delay and the faraday rotation of radio waves transmitted by an ionospheric beacon transmitter on board the geostationary satellite ATS-6. This satellite is located at 140 degrees west longitude, well suited for making these measurements from the Hawaiian equatorial anomaly location. The difference between the electron content as measured by the two techniques, after suitable corrections, is the plasmaspheric electron content. Measurements will be made for approximately 2 years to determine the diurnal and seasonal behavior of this parameter during magnetically quiet and disturbed conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0014, ARTIFICIAL INTELLIGENCE AND HUMAN ERROR PREVENTION

R.T. CHIEN, Univ. of Illinois, School of Engineering, Coordinated Science Lab, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DOT-OS-70047)

Intelligent computer systems for applications onboard commercial aircraft are being investigated. The major problem is to design a knowledge base which is structured such that it can be used effectively in real time. Information about the current status of the aircraft and the expected status of the aircraft must be kept current. In addition, faults relating to any of the aircraft systems must be detected, diagnosed and presented meaningfully to the pilot in real time. Furthermore, potential correction procedures must be generated by the computer for the diagnosed faults. The overall goal of this research is to provide the pilot with a reliable system which will be able to assist him in periods of high workload in order to enhance aircraft safety.

SUPPORTED BY U.S. Dept. of Transportation, Unspecified Unit

4.0015, TRAJECTORIES OF LIQUID DROPLETS EJECTED FROM AN AGRICULTURAL AIRCRAFT

A.I. ORMSBEE, Univ. of Illinois, School of Engineering, Aeronautical & Astronaut Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801

Flow field models for an agricultural aircraft are being constructed for the determination of trajectories of droplets and solid particles ejected from the neighborhood of the wing trailing edge. Trajectories have been computed for a horseshoe vortex model in ground effect, and scaling laws for scale-model testing have been established. Inclusion of propeller wake effects is now being considered. A test program is in the planning stage.

SUPPORTED BY University of Illinois

4.0016, MINIMUM-FUEL ORBITAL RENDEZVOUS

J.E. PRUSSING, Univ. of Illinois, School of Engineering, Aeronautical & Astronaut Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801

Fixed-time, minimum-fuel, multiple-impulse rendezvous solutions are being sought for the inverse-square field orbit problem. Previously obtained linearized solutions are used as starting solutions. One advantage of fixed-time solutions, in contrast to solutions for which the transfer time is unspecified, is that trade-offs can be made between fuel requirements and transfer time. Typically, longer transfer times require more impulses and less fuel, but the time-open minimum-fuel solutions can require inordinately long transfer times.

SUPPORTED BY University of Illinois

4.0017, RARE EARTH SEMICONDUCTOR LASER

C. MORRISON, U.S. Army, Harry Diamond Laboratories, *2800 Powder Mill Rd., Hyattsville, Maryland* 20783 (DA0F5789)

An experimental effort will be made to grow di-yttrium hafnium sulfide doped with Nd or other convenient rare earth ions, and a parallel theoretical effort to predict the excitation of the rare earth ion by conduction electrons will be initiated with the purpose of developing a new rare earth semiconductor laser material.

The particular materials of the generic type di-yttrium hafnium sulfide have been found to have band gaps of about 2 eV which is large enough to allow the 1.06 micron radiation typical of Nd to pass, yet small enough to allow a sufficient number of conduction electrons to excite a rare earth ion substituted for Y. Once experimental samples of this material are grown, various measurements and calculations will be made to determine their potential use as rare earth semiconductor lasers.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Harry Diamond Lab.

4.0018, BASIC LAB SUPPORT - ULAIDS

D.M. WATTERS, U.S. Navy, Air Test Center, *Patuxent River, Maryland* 20670 (DN793251)

To provide technical support and hardwar. .o integrate the Universal Locator Airborne Integrated Data System (ULAIDS) into the basic VSTOL laboratory.

Conduct joint NADC/NavAirTestCen systems integration studies and provide ULAIDS hardware for systems integration.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0019, AIR WEAPONS AERODYNAMICS TECHNOLOGY
M.V. KRUMINS, U.S. Navy, Weapon Dynamics Division, *Silver Spring, Maryland* 20910 (DN785079)

Develop the aerodynamic technology required to improve the kill probability of the present air-launched weapons as well as identify and produce such technology in order to meet the needs of the advanced air-launched missile systems of the future.

By means of analytical methods and experimental procedures in ground test facilities, produce aerodynamic knowledge to fulfill the above objective. Specifically, develop methods of predicting transition and augmentated heating due to roughness on missile seeker domes. Also, determine the tracking error resulting from bending of light rays that traverse the bow shock and the shock layer in front of the seeker dome at high supersonic Mach numbers. Advanced diagnostic techniques will be used in wind-tunnel tests to produce a data base from which empirical methods will be developed for predicting flow about missile bodies at high angle of attack, including induced side forces. Results from analytic computations, wind-tunnel and free-flight test will be used to demonstrate the feasibility of electrostatic sensors as means of measuring the attitude of a missile in flight.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0020, PERFORM ECONOMIC ANALYSIS/LIFE-CYCLE COST STUDY OF MNOS MEMORY
M. ECKLUND, Sperry Rand Corporation, Univac Defense Systems Div, *2750 W. 7TH Blvd., St. Paul, Minnesota* 55165 (DN781282; N62269-76-M-8550)

Technical objective - future and current Navy platform requirements indicate improvement is desired in the area of weight, reliability, maintainability, power, and access/cycle time. Currently, various memory technologies are being developed to replace discs and drums with emphasis on improvement in those areas. The memory technology being considered in this task is the MNOS (metal nitride oxide semi-conductor). The objective of this program is to perform economic analysis/life-cycle cost study of MNOS technology and to predict the cost of ownership. (This will include R & D, acquisition and operational support.) This contract will support work unit ZC902, Agency Accession No. DN 681082.

Approach. Contract mnos producer and user to perform this study.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0021, DEVELOPMENT OF REQUIREMENTS FOR GROUND STARTING EQUIPMENT FOR PROPULSION SYSTEMS
D.D. CROCE, U.S. Navy, Air Engineering Center, *Lakehurst Naval Air Station, Lakehurst, New Jersey* 08733 (DN696014)

Investigate propulsion systems air start requirements and determine the portable/fixed start systems to support these requirements.

Conduct exploratory studies to determine the projected engine start requirements over the next 25 years. Conduct fleet surveys to analyze capabilities of current equipment to meet updated requirements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0022, EFFECTS OF DRIVING GAS TEMPERATURE ON EJECTOR PERFORMANCE
R. DEJNEKA, U.S. Navy, Air Propulsion Test Center, *Trenton, New Jersey* 08641 (DN796800)

Determine the effect of driving gas temperature on ejector performance.

A low volume ejector model will be tested at the Naval Air Propulsion Test Center (NAPTC) with driving gas at ambient, 400 and 800 degrees F. Testing will be conducted at sea level, static conditions. measurements will include: thrust, driving gas flows, and diffuser exit temperature and velocity profiles.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0023, ANALYSIS OF THE SURFACE FINISH OF THE TWT HELIX
S. GILMOUR, State University of New York, Graduate School, *1300 Elmwood Ave., Buffalo, New York* 14222 (DF911720; F30602-75-C-0122)

The objective of this effort is to analyze the helix of TWT's fabricated for the defense satellite communication system (DSCS) II and III to determine surface finish, its relationship to rf loss and thermal conductivity from the helix and possible cause of failure.

Have SUNY at Buffalo analyze the helix thus providing the AF with an independent analysis. SAMSO is responsible for the DSCS system of which the transmitter is a vital part. SAMSO has recently (summer 1977) had several TWT's fail both on the ground and in space. As a result they have requested RADC assistance in analyzing the helix of the tube and have requested the information be provided to them by 31 Jan 78. These requests are documented in OCTP. In addition, SAMSO has requested RADC's support on a long-term basis. These are being handled through separate contractual efforts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0024, STUDIES OF LASER-INDUCED PHOTOCHEMICAL KINETICS
R.A. MCFARLANE, Cornell University, School of Engineering, Electrical Engin, *242 Carpenter Hall, Ithaca, New York* 14850 (DF040260; AF-AFOSR-2781-75)

Future Air Force operations in reconnaissance, communications and other areas will require new laser systems of varied output frequencies, higher operating efficiencies and increased power. Chemical lasers possess a high probability of contributing to these AF requirements. This research will study the formation and deactivation of excited atomic species of importance in laser systems based on transitions between the spin orbit levels of the electronic ground state of atomic iodine and related halogens. The measurements will be accomplished using a new technique for production and detection of atomic species in specific electronic states based on laser-induced photodecomposition and time-resolved, vacuum ultraviolet atomic absorption spectroscopy. Iodine (5p 1/2) atoms will be obtained from the photodecomposition of several molecules and the rates of atomic iodine deactivation by several partners will be measured. The efficiency of producing the excited atoms with respect to photolyzing wavelengths and collision partners will also be studied.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NC, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0025, COHERENT HIGH-RESOLUTION IDENTIFICATION PROCESSING
B. MORITZ, Measurement Concept Corp., *Rome, New York* 13440 (DF741900; F30602-77-C-0146)

The objective of this effort will exploit existing and future wideband microwave radar imaging technology and probe in depth into the near real-time image storage, comparison, and identification problem. The contractor will perform an analysis of methodologies for the collection and minipulation of new radar images and the specification of the data library and classifier requirements for a laboratory test bed system. Future system configurations will be emphasized. This program addresses the aircraft image identification phase of the overall tactical target identification (TTI) problem using the data processed from a wideband microwave radar system. In particular, this program will investigate the feasibility of various schemes and result in recommendations for future tactical radars. There are no tactical radar systems today which are equipped to image and identify non-cooperative aircraft. This deficiency is elaborated in TN-ESD-AFCRL-RADC-1709-69-07 (AWACS IFF).

This study is and early effort in a new and sophisticated technology. The contractor will study and evaluate concepts developed by the government and others and upon review of available radar source data documentation, shall perform a detailed analysis and design to convert a variety of radar data formats into a common format to facilitate the image identification process. This effort shall include consideration of sources from analog recordings and computer target simulations in addition to digital RTI recordings from several sources.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0026, STRUCTURAL AND KINETIC PROPERTIES OF GRAPHITE INTERCALATED COMPOUNDS

D.L. CHUNG, Carnegie Mellon University, Graduate School, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF051500; AF-AFOSR-3536-78)

AF function - airborne systems utilized for command, control, communications, reconnaissance and surveillance depend heavily upon interconnected electronic components. Opportunity - improved performance of these systems can be expected from the use of less expensive, lighter materials such as intercalated graphite compounds for electrical conductors. Intercalated graphite compounds, weighing about one fourth of that of copper, could have conductivities greater than that of copper. Objective - the objective of this research is to contribute to the understanding of the basic physical properties of intercalated graphite compounds. How work contributes - this work should contribute to the development of intercalated graphite compounds that could replace copper as the dominant electrical conductor of airborne systems.

The structural and kinetic properties of graphite intercalation compounds will be studied. Attention will be given to the microstructure which varies with the parent graphite material, the intercalate species and concentration, the sample preparation technique, the interaction of the intercalate with structural defects, the epitaxial growth of the intercalate on the intercalate with structural defects, the epitaxial growth of the intercalate on the intercalated compound, the kinetics of intercalations, and the kinetics of exfoliation. Thermal gravimetric analysis, auger spectroscopy, scanning and transmission electron microscopy, low- and high-energy electron diffraction and dilatometry will be used to investigate compounds based on various types of pristine graphite materials, such as pyrolytic graphite, graphite fibers, graphite whiskers, and grafoil.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0027, OZONE MEASUREMENT SYSTEM USING MILLIMETER-WAVE TECHNIQUES

W.J. WILSON, Univ. of Texas, School of Engineering, Electrical Engin, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: The atmospheric ozone layer shields life on earth from harmful solar ultraviolet radiation. The introduction of man-made chemicals, such as fluorocarbons and SST exhaust gases, into the ozone layer could deplete the ozone, producing disastrous effects for life on earth. Therefore, it is important to monitor continuously the ozone content in the earth's atmosphere and determine if any significant changes are occurring. In this research, we propose to design a ground-based atmospheric ozone measurement system using millimeter-wave radio techniques. It will be superior to present ozone measurement methods because it will provide high-accuracy, absolute vertical ozone distributions between 10-90 km altitude, and total ozone content, in real time, day or night. In this system, the ozone emission spectrum, of a strong rotational line near 100 gHz, will be measured and vertical distribution information is directly obtained due to the pressure broadening of the line in stratosphere and mesosphere. The vertical ozone distribution will be calculated using a parametric ozone model and it is estimated that model parameters will have errors less than 5% and that the total ozone content will be measured with errors less than plus or minus 3%. This is a significant improvement over present ozone measurement techniques.

SUPPORTED BY University of Texas

4.0028, ORBITAL PHOTOGRAMMETRIC TRIANGULATION WITH TRANSLATIONAL AND ROTATIONAL DYNAMICAL CONSTRAINTS 15551-GS

J.L. JUNKINS, Virginia Poly. Inst. & St. U., Graduate School, *Burruss Hall, Blacksburg, Virginia* 24061 (DA0F9148; DAAG29-78-G-0043)

To develop improved methods for orbital photogrammetric triangulation which has a potential for resulting in improved prediction aspects of the orientation of the spacecraft. Relevance - accurate mapping and point positioning have obvious relevance to a variety of military activities. The planned work shows promise of contributing to a better capability for controlling photogrammetric procedure from spacecraft. Engineer topographic laboratories and Defense Mapping Agency scientists have attested to the relevance of the proposal.

Methods will be developed to reduce the number of unknown parameters and thus simplify the consideration of the translationally and rotationally constrained variables of a camera in space. The central new idea is that the rotational motion of the camera (spacecraft fixed) must be a rigorous solution of the spacecraft's rotational equations of motion. This is a continuation of work initiated under Accession Number DA0E9282.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0029, SOLID ROCKET MOTOR EXHAUST ABLATION RESEARCH

L.P. ANDERSON, U.S. Navy, Surface Weapons Center, *Dahlgren, Virginia* 22448 (DN884049)

To develop analytical research methods for predicting the effects of solid propellant rocket motor exhaust on ablative materials. This work includes developing a mathematical model to calculate timedependent exhaust flow fields from present and future solid propellant rocket motors. And the development of a theoretical method to analyze the coupled thermal ablation and particle erosion caused by the exhaust environments of these rocket motors.

A two-dimensional, time-dependent hydrodynamic code will be extended to include the effect of two-phase flow and equilibrium chemistry. The modified program will be used to compute the time-dependent flow field from various rocket motors impinging on either flat plates or into ducted systems. The results of the flow field calculations will be used as input to thermochemical and particle erosion computations. An existing thermochemical ablation code will be modified to include particle erosion resulting from a solid rocket motor exhaust impingement. Results will be compared with available experimental data for similar conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Surface Weapons Center

4.0030, TEMPERATURE MEASUREMENT IN FATIGUE DAMAGE ANALYSIS

B.I. SANDOR, Univ. of Wisconsin, School of Engineering, Engineering Mechanics, *Madison, Wisconsin* 53706 (DF139450; AF-AFOSR-3194-77)

The accuracy of crack life predictions required by USAF MIL-A-83444 depends on the careful characterization of the crack growth damage process. The principal objective of this effort is to experimentally characterize the evolving patterns of plastic deformation that develop in the notch root regions during the course of variable amplitude loading histories. Characterization of the magnitude and extent of the plastic deformation is an essential requirement for structures operating under service loadings. The return on this investment will be an improved structural life prediction capability that comes from an improved understanding of the localized deformation processes that occur in constrained regions.

Fine wire 0.003 inch welded thermocouples will be employed to measure temperature changes of less than 0.1 deg F in response times of 10 to the minus 4th power seconds in regions local to notches. These temperature changes will be related to the deformation processes that accompany the application of load to the structure. Substantial temperature changes can be measured during the occurrence of plastic deformation induced by static and

cyclic loads. Tests will be conducted to define plastic zone sizes/shapes in notched specimens for simple applied load conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

4.0031, RESEARCH ON TEST RANGE INSTRUMENTATION FOR MISSILES AND ROCKETS 14855-A-E

K.M. PELL, Univ. of Wyoming, School of Engineering, Mech Engin, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (DA0F8944; DAAG29 77 G0090)

To develop analytical models for processing data obtained from a remote laser attitude sensing system for missiles, to investigate remote attitude determination techniques applicable to non-rolling or slowly rolling missiles and to investigate pressure measurement techniques adaptable to range instrumentation. Relevance - data required in research and development testing of tactical weapon systems includes the rapid determination of vehicle position and attitude as a function of time. This research directly addresses this requirement and is strongly relevant to the missile test range instrumentation requirements at the Army Missile Command.

Alternative mathematical formulations for the attitude sensing system reflecting missile dynamic conditions, sensitivity and relative position, and efficient solution algorithms will be performed. Different on-board reflector configurations will be investigated for use on slowly rolling vehicles and system concepts applicable to on-board pressure measurements will be defined.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, ATMOSPHERE EXPLORER - C SATELLITE AND ROCKET DATA ANALYSIS

M.H. REES, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701

ATMOSPHERE - To compare rocket and satellite observations of auroral emissions, particle fluxes, and atmospheric composition with theoretical predictions.

SUPPORTED BY Alaska State Government

5.0002, SPECTRAL DEPENDENCY AND POLARIZATION OF LIGHT SCATTERED BY ATMOSPHERIC ICE CRYSTALS

G.G. SIVJEE, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701 (ATM77-17511)

Ice clouds play an important role in the atmospheric radiative transfer and in the interpretation of satellite data. This is especially important in the polar regions and high altitudes where ice crystals are a common constituent of the atmosphere. Therefore, it is essential that the scattering and absorption properties of ice crystals be property formulated and not approximated from ellipsoidal particles. Because of the inherent complexity of a mathematical formulation, we propose to conduct a field experiment to determine the effect of atmospheric ice crystals on the scattering of light in the visible and near-infrared. The presence of three distinct types of ice crystal phenomena at ground level around Fairbanks, (single ice crystals of a particular habit precipitate for periods of a day to a week) and the successful development of precision spectrophotometers capable of operating under extreme low temperatures, have eliminated to a large extent the limitation imposed on field experiments to determine scattering properties of ice crystals. With these experiments the scattering of light by ice crystals, falling with a preferred orientation in the atmosphere, will be determined. The results will express the scattered irradiance per unit volume per unit steradian as a function of wavelength, scattering angle, orientation of the scattering plane to the vertical, and the concentration and size distribution of the ice crystals.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0003, LDS RADAR BACKSCATTER MODELING

G.G. SCHABER, U.S. Dept. of The Interior, Geological Survey, Br of Astrogeologic Studies, *601 E. Cedar Ave., Flagstaff, Arizona* 86001 (9580-02040)

STATE TO WHICH PROJECT PERTAINS: California.

The total thrust of work for FY 78 will be simply to compile, analyze and publish the vast amount of SLAR image data, radar power spectra and surface physical properties data from Death Valley accumulated by this project over the past several years. This work will culminate with preparation of a U.S. Geological Survey Interagency Report (Astrogeology series). This report will be distributed during FY 78 to 300-400 persons active in various terrestrial and planetary radar programs. The Interagency Report will be preceded by an article on derivation of radar backscatter models currently in preparation (with Walter E. Brown, Jr. of JPL) for submission to Science in FY 77. The Interagency Report will be followed by formal publication of the complete radar backscatter model investigations as a U.S. Geological Survey Professional Paper; manuscript to be submitted for Director's approval by late FY 78 or early FY 79.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0004, ENERGY AND MOMENTUM BUDGETS OF THE ATMOSPHERE OVER THE TROPICAL PACIFIC OCEAN

B.C. WEARE, Univ. of California, School of Agric. & Envir. Sci., Land Air & Water Resources, *Davis, California* 95616 (ATM77-14669)

Large-scale sea surface temperature anomalies in the eastern tropical Pacific have been shown to have significant far-reaching meteorological consequences, not only within the tropical atmosphere, but within the extratropical troposphere as well. Recent studies have indicated that this region not only shows the most convincing evidence of significant air-sea interaction but also suggests that it may be very important in influencing global 'climate' variations having periods of years to decades. The general aim of this study is to discern the mechanisms of the atmospheric response and the possible return effect back onto the ocean by using all available data for the atmosphere over the tropical Pacific. The data base would include not only the rather sparsely spaced observations at meteorological stations but also air, sea, and dew point temperatures and resultant winds derived from marine report summaries and the more recently available satellite estimates of cloud brightness, radiative fluxes, and liquid and vapor water content. In order that our conclusions might have the greatest possible statistical and physical significance, the period of the investigation will be nearly the entire epoch of upper air observations, 1957-75, and the area will include the entire Pacific basin east of about 120 degrees E between 30 degrees N and 30 degrees S. The aim of the study is to calculate variations in the most important components of the atmospheric energy and momentum budgets. These calculations can then be compared with or incorporated into mathematical models of the global circulation.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0005, VIKING PHYSICAL PROPERTIES

H.J. MOORE, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *345 Middlefield Rd., Menlo Park, California* 94025 (7-9580-00734)

The Viking Landers on Mars have continued to operate successfully. This project will involve participation in the Viking Mission. Such participation will involve planning, execution, and analyses of spacecraft, imaging, and other data to further refine knowledge of the physical properties of the surface materials of Mars such as cohesion, angle of internal fraction and density.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0006, SATELLITE SCINTILLATION ANALYSIS

I.J. ROTHMULLER, U.S. Navy, Environmental Sciences Dept., *San Diego, California* 92152 (DN888580)

Achieve understanding of triggering and morphology of ionospheric irregularities which cause satellite scintillations by analysis of satellite data. This will allow development of techniques to mitigate scintillation effects on present systems and to design future systems to avoid or account for scintillations.

Data taken at two frequencies at NavCommSta guam will be analyzed for several nighttime periods and scintillation activity correlated to thermospheric winds.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0007, NAVY ENVIRONMENT - SATELLITE OCEANOGRAPHY AT SCRIPPS

R.L. BERNSTEIN, Univ. of California, Scripps Inst. of Oceanography, *P.O. Box 1529, San Diego, California* 92038 (DN775673; N00014-75-C-0152)

Fleet activities require a knowledge of surface wind and ocean wave and thermal conditions over broad areas. This is possible only with quantitative remote sensing. In order to scientifically understand and process the remote sensing data it must be made available to competent oceanographers for physical analysis and correlation.

This work unit will allow Scripps to study the hardware, software, and scientific requirements necessary to gain a significant satellite capability and to demonstrate to appropriate funding sources their need for such data and a rational program for exploiting the data with high-quality basic oceanography.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0008, SURVEILLANCE AND PREDICTION OF THE ENVIRONMENTAL EFFECT OF HIGHWAY FACILITY BY REMOTE SENSING

S. MATHUR, Ontario Min. of Transp. & Com., *1201 Wilson Ave., M3m 1J8, Downsview, Ontario, Canada* (164805 (HRB NO.))

It is expected that aerial remote sensing is a simple, quick and relatively inexpensive means of documenting ecological changes and their progression with time. There are several phases to this study; a state-of-the-art report has been prepared and is now available. Two sites have been selected (one on Hwy 402 and on on Hwy 522 in the Canadian Shield) and spring, summer and fall imageries have been obtained. Field data gathering and interpretation analysis prior to construction is complete and the remainder of the study is dependent on the award of the contracts. Changes to the environment following construction will be monitored over a three-year period. /RTAC/

SUPPORTED BY Ontario Ministry of Transportation & Communications

5.0009, BUOY/SEASAT WINDS

D. HALPERN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8B326428)

PROJECT OBJECTIVE: To compare moored wind observations made during JASIN with SEASAT-A wind data.

CURRENT YEAR PLAN: Prepare and assemble wind-measuring systems. Conduct wind measurement program between about 1 August and 15 September 1978.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0010, GULF OF ALASKA OCSEP CURRENTS

D.V. HANSEN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (R7120816)

PROJECT OBJECTIVE: To obtain Lagrangian current data for Gulf of Alaska Project.

CURRENT YEAR PLAN: Free drifting buoys are to be deployed in the Gulf of Alaska for subsequent tracking by the NIMBUS-6 satellite. Lagrangian current data and statistics will be computed from the buoy trajectories.

SUPPORTED BY U.S. Dept. of the Interior, Bureau of Land Management

5.0011, EXPERIMENTAL STUDIES ON LASER BEAMS

G.R. OCHS, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8AA71310)

OBJECTIVE: Experimental studies of the use of visible and infrared light beams for remotely sensing atmospheric parameters, particularly wind and turbulence.

CURRENT YEAR PLAN: Effort will be made to demonstrate the optical wind sensor to prospective users in various applications, and to improve the present optical devices to measure the wind in more detail and, through the use of infrared, to make them more immune to interfering background lights and to sunlight.

PROGRESS: An improved 'saturation-resistant' wind sensor has been built and tested. Three of the saturation-resistant units have been combined in a divergence triangle and used for a pre-Sesame test at Kimball, Nebraska.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0012, STUDIES IN REMOTE SENSING APPLIED TO GEOCHEMICAL EXPLORATION

F.C. CANNEY, U.S. Dept. of The Interior, Geological Survey, Branch of Exploration Research, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9330-00815)

STATES TO WHICH PROJECT PERTAINS: Topical Project: some work done in Maine, Montana and Colorado.

The overall objective of this project is to develop remote-sensing techniques for identifying mineralized areas in regions of heavy vegetation. Vegetation can be used as a link between abnormal chemical conditions in the soil and an aircraft- or spacecraft-mounted sensor for the following reasons: (a) plants generally reflect their geological environment by their distribution patterns and minor-element content; and (b) laboratory and field studies have established that metal stressed and normal vegetation can have subtly different spectral characteristics. Therefore, a geochemical anomaly in a heavily forested area might be detected by spatial and/or spectral changes in the reflection of the vegetation canopy.

To date aerial surveys using color infrared film, multiband photography, and multispectral line scanners, coupled with the simpler interpretative techniques have not been successful in discriminating geochemical anomalies in heavily forested areas. Apparently the reflectance anomaly was totally obscured by variables unrelated to soil geochemistry. However, recent research in cooperation with W. Collins of NASA's Goddard Institute for Space Studies, and using a specially built high-resolution airborne spectrometer, suggests that high-resolution spectral data, where processed by computerized waveform analysis techniques, can be used to separate vegetation growing over a mineralized zone from background vegetation.

In the current year, additional testing of the instrument and analysis techniques will be done at several mineralized sites of different types.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0013, TUNNEL DETECTION

F.C. FRISCHKNECHT, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9780-01809)

Objectives are to complete an assessment of the effectiveness of the airborne INPUT electromagnetic system in locating underground workings which contain well-grounded metallic conductors. Field tests will be made over sites in Colorado and additional scale-model studies and numerical calculations will be carried out.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0014, AIRCRAFT OPERATIONS
R.A. MILLS, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9790-00917)

STATES TO WHICH PROJECT PERTAINS: All United States.

With the new airborne geophysical exploration systems in the Fairchild Heli-Porter and the Beech Queen Air completed and operational, major emphasis will be placed on the flying of our scheduled survey programs and the further refinement of systems and techniques. Planned programs include surveys in these categories and locations: Spectral reflectance and thermal IR - Hawaii, NW U.S.; Very low frequency studies - Hawaii, Colorado; Aeromagnetic - Hawaii, Arizona; Side-looking radar -Kansas, Missouri; Gamma ray - NW U.S.; Microwave.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0015, SEASAT A
UNKNOWN, U.S. Dept. of Commerce, Natl. Meteorological Center, *5200 Auth Rd. S.E., Washington, District of Columbia* 20023

OBJECTIVE: To design, construct, test, and evaluate the analysis-forecast system techniques required for extracting the maximum information content of the meteorological systems on the SEASAT-A satellite planned for launch in May 1978.

STATUS: The principal staff member joined the Development Division in August 77. Preliminary study and consultation have commenced.

PLANS FOR FY78: (1) Work on the resolution of wind direction ambiguity. (2) Establish the statistical characteristics of real data. (3) Develop methods for insertion of the data into the analysis system. (4) Examine the theoretical basis for deriving the wind data and consider alternative boundary layer formulations.

Part 2 of 9.

SUPPORTED BY U.S. Dept. of Commerce, National Weather Service, National Meteorological Center

5.0016, DEVELOPMENT OF TECHNIQUES FOR INVENTORYING ENVIRONMENTAL QUALITY OF FOREST LAND
C.C. MYERS, Southern Illinois University, School of Agriculture, Mcintire Stennis Program, *Carbondale, Illinois* 62901 (0065334; ILLZ-73-R-037)

OBJECTIVE: Define environmental units in the forested area of Southern Illinois. Identify factors that contribute to the environmental quality of these units. Devise methods of measurement and analysis for assessing the importance of these factors. Develop sampling and data processing procedures for inventorying environmental quality.

APPROACH: On early and most recent aerial photos of Southern Illinois units will be established. Within each unit types of environmental disturbance will be identified on the aerial photo. From the population data a probability sampling scheme will be devised for selecting environmental units. In the selected units ground data correlated to the photo data and measures of environmental quality will be obtained. Multivariate analysis procedures will be used to relate corrected photo data to measurements to environmental quality. The derived models will be field tested and computer processing methods will be devised.

PROGRESS: An equal probability sampling scheme was devised to select nine watersheds for study. Land use for the total area of 3,478 acres was determined and water samples were taken from the intermittent streams over a six-week period. Water quality was within the range of the Illinois Pollution Control Board Standards with the exception of fecal coliforms which was more than 2 times the allowable maximum. Logging slash was measured on three harvesting operations in Southern Illinois. Residue ranged from 29-93 cu. ft./mbf harvested for the species studied. An SIU forest computer mapping system has been devised to display individual resource items. Items can be located by selected classifications and displayed by coded symbols. The initial data displayed trees by diameter class and species on the agriculture lawn.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Illinois

5.0017, MEAN SEA LEVEL DISCREPANCY
N.K. SAXENA, Univ. of Illinois, School of Engineering, Civil Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801

The mean sea level discrepancy along the U.S. Pacific Coast caused by the oceanic and geodetic leveling has not yet been resolved. During the past decade several attempts were made both by oceanographers and geodesics. The current study will investigate the error sources in geodetic techniques. It will further investigate an independent method using deep sea tide gauges, buoy and satellites, which was earlier suggested by this investigator.

SUPPORTED BY University of Illinois

5.0018, NAVY ENVIRONMENT - ARCTIC COASTAL PROCESSES
W.J. WISEMAN, Louisiana State Univ. Systems, Coastal Studies Institute, *University Station, Baton Rouge, Louisiana* 70803 (DN575161; N00014-75-C-0192)

The objectives of this research are to: (a) define the short-term variability of tundra cliff coastal systems from the onset of above-zero temperatures, breakup and marine processes through the open-water period; (b) define the relationships of cliff sediment type, stratigraphy, sediment ice volume content, etc, to cliff erosion; (c) determine the relationships of specific atmospheric and marine processes to the short-term thermal-mechanical erosion of the bluffs, resulting beach cycles and the spatial and temporal transport of sediment from the bluffs; (d) initiate a program of research directed at an investigation of fjord circulation and morphology.

A series of profiles will be acquired to tundra bluff areas fronting the Chukchi Sea and Pearl Bay; the profiles will be compared and correlated with previous measurements and with current aerial and satellite imagery. A coastal reconnaissance (aircraft and boat) will be made of the fjord areas of Svalbard (Spitzbergen).

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0019, CRUISE OF USCGC GLACIER FOR STUDIES OF WALRUS AND WHALES
G.C. RAY, Johns Hopkins University, School of Hygiene & Pub. Hlth., Pathobiology, *615 N. Wolfe St., Baltimore, Maryland* 21205

Detailed observations of the behavior and ecology of the Pacific walrus, Odobenus rosmarus, will be made from the USCGC Glacier during the Arctic Summer West Cruise. This cruise provides the first opportunity for intensive study of these animals during the summer. The primary goal is to obtain data on hauling-out behavior, behavioral thermoregulation, mother-young interactions, and male-male, male-female and female-female tusk displays. Models already exist for both hauling-out behavior and behavioral thermoregulation. These models need verification. Tusk displays have been described for a small all-male herd summering in Bristol Bay. These observations need expansion and confirmation. A second goal is the radio tracking of individual walruses and whales to determine movements and diving times. Additional tasks will include possible observations of the bottom in areas where walrus are feeding, ground-truth data to correlate with NASA remote-sensing imagery, and recording of underwater vocalizations of walrus and whales.

SUPPORTED BY National Geographic Society

5.0020, LAND USE, TAXES, AND SERVICE IMPACTS OF COLUMBIA, MARYLAND, ON HOWARD COUNTY
W.J. BELLOWS, Univ. of Maryland, Agric. Experiment Station, Agricultural & Resource Econ, *College Park, Maryland* 20740 (0071638; MD-A-019-AL)

OBJECTIVE: Document the growth in Columbia and in Howard County by such classifications as: Change in land use. Area devoted to residential, commercial, industrial uses. Examine impact of growth on services provided. Assess the burden of financing the new services provided to Columbia.

APPROACH: Use available data -- aerial photographs, local, and federal agencies -- to study present and past land use patterns.

Services provided Columbia will be compared with services provided to parts of Howard County that have experienced little growth. Columbia tax receipts will be compared with receipts from other parts of the county. These will be evaluated in terms of services provided.

PROGRESS: During the summer and fall work on this project has been largely devoted to an extensive literature review. The review has been directed at three areas of interest: New towns and their development. Methodology of new town and regional studies. Fiscal impact of development, especially on new towns.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Maryland

5.0021, AFOS DATA ACQUISITION AND INTEGRATION - AFOS COMPATIBILITY

R.R. REYNOLDS, U.S. Dept. of Commerce, Equipment Development Lab., *Silver Spring, Maryland* 20910 (8C2714)

TECHNICAL OBJECTIVE: To coordinate, define and develop AFOS related data acquisition, preprocessing and interfacing automatic and part-time manned weather stations, upper air sites, and radar installations.

APPROACH: Use the results from the 'AFOS Data Acquisition Interface Study' to define equipment.

PROGRESS: An Automatic Observation (AUTOB) system was developed by EDL to perform automatic cloud and visibility observations. Two systems, one at Summit, Alaska, and one at Wendover, Utah, have been operational since this fall of 1976. AUTOB uses a microprocessor to generate a message giving sky cover up to 6,000 feet and visibility to 8 miles. The sky message is formatted using SCT (scattered), BKN (broken), and OVC (overcast) terminology.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Weather Service

5.0022, MULTISPECTRAL, REMOTE SENSING AS A FRESHWATER QUALITY SURVEILLANCE TOOL

D.E. CARRITT, Univ. of Massachusetts, Graduate School, Marine Science, *Amherst, Massachusetts* 01002 (A-084-MASS)

The primary objective of this study is to demonstrate the utility of remote, multispectral sensing as a unique tool for the study and surveillance of environmental properties in freshwater resources in the Commonwealth of Massachusetts. Proposed remotely sensed, multispectral data will be used to evaluate: a) rate of eutrophication from successive estimates of standing crop of chlorophyll-containing plankton, b) location of point sources of sediment and colored water inflow together with the distribution throughout the receiving water and mixing processes between influent and receiving waters, c) changes in bottom topography, d) distribution of surface slick materials, e) mixing processes in natural waters by measuring the time and space distribution of added tracers, dyes and floats, f) the correlation between indices of land and aquatic area uses and indices of water quality or potential of a given resource as a single or multiple use resource in resource management considerations.

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

5.0023, IONOSPHERIC REFRACTION FOR DEEP SPACE SURVEILLANCE RADARS

R.S. ALLEN, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF580880)

AF function - advanced radar and navigation systems. Deficiency -the sensitivity of ground based and satellite radars which detect and track deep space targets is severely limited by ionospheric effects. The normal variability of the ionosphere causes target signal phase to vary so rapidly that present and proposed radars can only integrate coherently for small samples of 10 to 100 seconds. Objective - develop a technology to support ADCOM requirements for deep space systems, tailored to the range extension modification of SPADATS radars and to the deep space surveillance radar system. How research contributes -increases the sensitivity of radar detection and tracking in deep space so that trade-offs can be made between system performance and costs. Provides a technique to use local measurements of changes in the ionosphere so that AWS predictions of median ionospheric conditions can be adapted to the real-time conditions in the attack corridors. This will make the range extension feasible at existing ADCOM radars. Provides design and development technology for the follow-on deep space surveillance systems for use in preliminary design and system development. Investigate time rate of change of ionospheric refractive effects for deep space surveillance systems, using existing AFGL models of electron density profiles and of ionospheric parameters. Develop and validate computer algorithms so that the Air Weather Service can provide a monthly median prediction of refractive effects for deep space radars. Develop adaptive techniques to use real-time local radar and ionospheric measurements to correct for the hour-to-hour variability of the ionosphere. Determine the optimum grid of local observations and the optimum interval between updates to meet the performance requirements over the system field of view.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, LINE-OF-SIGHT CLIMATOLOGY

D.D. GRANTHAM, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF581520)

AF function - operation of AF systems using visual or infrared wavelengths for detection or tracking and systems using millimeter-wavelength communications. Deficiency - AF systems designated above have operations which are often inhibited or terminated due to cloud, haze or precipitation interference. Cloud-free line-of-sight (CFLOS) probabilities are needed for AF operational areas. Objective - to determine probabilities of cloud-free and haze-free lines-of-sight from various aircraft altitudes to earth and to space. To develop precipitation-free clear line-of-sight (CLOS) and CFLOS atlases for various regions of the northern hemisphere based on radar observations, aircraft observations, and a statistical model using ground observations of cloud cover. How development contributes - CFLOS probabilities will aid designers and operators in determining the utility of AF systems. The atlases will depict regions where unacceptable risks of failure are expected. The microwave attenuation climatology will provide quantitative information on how often precipitation will affect transmission along millimeter wave ray paths at various elevation angles for differing climatic regions.

A LOS in-flight data collection program is being conducted to gather clear, cloud-free or hazy line-of-sight observations over Europe at altitudes of 10,000 feet and below. These in-flight observations are being made by U.S. Army helicopter squadrons in Europe. These observations, along with those previously collected, will be analyzed to determine clear, cloud-free and haze-free LOS probabilities to the ground, horizon, and sky from various altitudes along flight paths over europe. A model has been developed which gives CFLOS probabilities through the atmosphere for 10, 20, . . . , 90 degrees elevation angles based on the climatic cloud cover statistics from a given location. The model will be applied to about 1,200 stations to produce CFLOS atlases for regions of the Northern Hemisphere. Three-hourly radar-scope photographs were taken at 17 continuously-operating National Weather Service (NWS) storm radar sites in the U.S. National Climatic Center. Personnel at Asheville, NC have extracted data from these special photographic observations and will prepare them for computer analysis at AFGL. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, SATELLITE MEASUREMENTS OF SOLAR UV

H.E. HINTEREGGER, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF581280)

AF function - vehicle tracking during flight and reentry, trajectory prediction, communication systems. Deficiency - insuf-

ficient data to allow accurate modelling of the average composition and structure of the upper atmosphere and of the ionosphere, and to predict the response of the atmosphere and ionosphere to temporal variations in the solar input. Objective - determine the importance of the solar radiation within the spectral range from 140 to 1,850 angstroms in maintaining the composition and thermal structure of the upper atmosphere. Develop a set of indices characterizing the temporal variation of this solar radiation, which is the putative cause of the variations in the atmospheric composition, density and thermal structure. How research contributes - measurements of this solar radiation are made eleven times a day, at various latitudes, longitudes and solar zenith angles. The measurements are continued through many solar rotations, and are to be examined in correlative studies with other observed effects. Atmospheric composition, density and temperature are measured by analysis of the attenuation profiles of selected solar emission lines during perigee passes and at sunrise and sunset.

Specially designed grazing incidence spectrometers are mounted on a solar oriented platform on the NASA Atmosphere Explorer series of satellites. These instruments cover the spectral range from 140 to 1,850 angstroms, and each is made up of 24 individual spectrometers, multiplexed onto 12 detectors. The satellite contains an apogee motor, so that perigee passes down to 120 km can be maintained by an occasional apogee burn. The low perigee altitude allows the study of attenuation of the solar radiation in certain emission lines, from which composition, density and temperature of the upper atmosphere may be derived. Above the attenuation region, but below the energetic particle belts, unattenuated incident solar fluxes are measured. During sunrise and sunset at the satellite the occultation of the sun by the upper atmosphere allows analysis of the atmosphere remote from and below the satellite orbit. Three separate orbit orientations are used. The AE-C orbit has 65 degree inclination, AE-D (failed in January 1976) was in a polar orbit, and AE-E, overlapping the second in time, has a near equatorial orbit. Each orbit had a nominal perigee of 150 km and initial apogee of 4,000 km. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, ENCODER/TIMER/DECODER DEVICE USING CMOS CIRCUITRY FOR STANDARDIZED BALLOON CONTROL PACKAGE

H. LAPING, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF580620)

AF function - advanced balloon systems for surveillance, reconnaissance, communications, environmental research. Deficiency - the existing standard instrumentation system for balloon flight-control and data gathering functions is no longer adequate for many flights due to the ever increasing number and complexity of the scientific payload requirements. Objective - design, develop and test an improved encoder/timer/decoder, for the purpose of increasing both the reliability and flexibility of the AFGL standardized balloon flight instrumentation system. How research contributes - with a standard flight control system that has been advanced to the state-of-the-art, the current need for special control systems on a majority of balloon flights will be reduced. This will result in both dollar and manpower savings.

A 16-channel variable speed data encoder and an 18-channel command decoder incorporating a precision flight safety timer will be designed, bread-boarded and tested in-house by AFGL personnel. From the in-house design final flight models will be developed and tested under contract. the final units will be integrated into a standardized AFGL balloon flight instrument and flight tested by AFGL personnel. A technical report will be the end product of the IHWU.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, DETERMINATION OF STRATOSPHERIC WINDS AND TURBULENCE AS A FUNCTION OF LATITUDE USING PHOTOS OF SMOKE TRAILS

A.F. QUESADA, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF581160)

AF function - to gain quantitative understanding of stratospheric dynamics needed to predict environmental effects of AF aircraft and missile operations in and through the stratosphere. Deficiency -measurements of transport processes by observation of smoke trails. How research contributes - will provide the data to define and model transport mechanisms.

Photographic observations of upper atmosphere or stratospheric smoke releases provide data relevant to the physical state and motion of the stratosphere or lower thermosphere. Of special interest are smoke trail positions, drifts, and growth, from which ambient winds, wind shears and divergences are determined by photographic triangulation. The results of these studies provide improved physical models of the atmosphere in the natural and disturbed state, as well as data on winds, wind shears and turbulence at supersonic aircraft operating altitudes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, TOPSIDE IONOSPHERE MEASUREMENTS OF LOW ENERGY

R.C. SAGALYN, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF580770)

AF function - surveillance, communications, navigation and ionospheric modelling. Objective - develop instrument for monitoring ion and electron densities, temperature and scale height in the topside ionosphere to be used as inputs for ionospheric models. How research contributes - permits improved space communications, frequency management and surveillance at HF and UHF frequencies.

The satellite experiments will be designed, fabricated, tested and integrated in the DMSP satellite. Software programs will be developed to operate on GWC UNIVAC for rapid transmittal to AWS Ionosphere Predictions Program.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, ATMOSPHERIC OPTICAL AEROSOL MODELING

E.P. SHETTLE, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF581010)

AF function - reconnaissance, communications, surveillance, guidance, target acquisition and tracking. Deficiency - the performance of any optical system looking through the atmosphere is significantly degraded by atmospheric light scattering and absorption. Therefore, it is dependent in a complex way on the variability of the state of the atmosphere in the theater of operation. Objective - perform the necessary studies for the development of models for those physical properties of aerosols which affect the propagation of optical/ir radiation. Determine the relationship between the distribution and properties of the aerosols and the general meteorological conditions. Define such aerosol models in terms of their statistical significance. How research contributes - development of these models of the aerosol optical properties should lead to an improved capability to predict the effects of the atmosphere on E/O systems performance, such as deterioration of optical/ir images, or signal reduction.

Develop from empirical data, and basic physical concepts, models for the spatial and temporal variations in the distribution and composition of the aerosol optical parameters in the atmosphere, and their correlation with the physical state of the atmosphere such as humidity, airmass type, air circulation patterns, etc.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, STUDY OF ENERGY BALANCE AND PLASMA MOTIONS IN THE IONOSPHERE

A. DALGARNO, Smithsonian Institution, *60 Garden St., Cambridge, Massachusetts* 02138 (DF581840; F19628-78-C-0047)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of energy balance and plasma motions in the ionosphere for the design of AF communication and navigation systems. Objective - Development of theoretical and computational techniques for the calculation of quantities pertaining to the energy balance and plasma motions in the ionosphere including the effects of particle precipitation and electric fields. Satellite measurements shall serve as inputs to calculations and as a test of the validity of the theory. How research contributes -provides data and analysis essential for the design and maximum utilization of communications, guidance and surveillance systems such as the Defense Satellite Communication System, AF SAT COM II, 414l. The work provides an understanding of the dynamical processes in the ionosphere.

Study theoretical and computational procedures for calculation of energy balance, plasma motions and electrical conductivities on a global basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, EARLY REMOTE DETECTION OF FOMES ANNOSUS

C.E. OLSON, Univ. of Michigan, School of Natural Resources, *Ann Arbor, Michigan* 48104 (0067793; MICY00039-F)

OBJECTIVE: Evaluate capabilities of remote sensors for early detection of Fomes annosus. Identify optimum system parameters for pre-visual detection of the disease.

APPROACH: Review available imagery of NASA Test Site 190 for tonal anomalies in conifer stands and relate to vigor and disease conditions through field verification. Evaluate level-slicing with single channel and ratioed MSS data for pre-visual detection of tree-vigor decline.

PROGRESS: Laboratory work has progressed to the point where an operational field test of a multispectral scanner in the May-June time period should be the next step. Work on reflectance from pine canopies indicates that the 0.43 to 0.50 (blue) band should receive much greater attention for forest stress detection than generally supposed. This recommendation is believed applicable to damage by insect vectors as well as pathogens.

SUPPORTED BY Michigan State Government

5.0032, MIGRATION OF MEANDERS IN ALLUVIAL RIVERS

R.L. HOOKE, Univ. of Minnesota, School of Earth Sciences, Geology & Geophysics, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (EAR77-13898)

This project involves a study of the migration of meanders in alluvial rivers. Meander migration rates in several bends on three or four rivers will be measured using plane table surveys and aerial photographs. Data on former positions of meanders are available from observations and photographs over a period of several decades. Properties of bank materials will be investigated using standard tests of soil mechanics. Field studies will also include measurements of bed geometrics and velocity distributions. Shear stresses will also be determined from laboratory and finite-element numerical models. The studies will be used to establish an empirical constitutive relationship among shear stress, bank materials, and erosion rates. The relationship will be used to study the development of meander patterns in response to floodplain characteristics. The results will be added to the understanding of river erosion and will be useful in practical applications in environmental planning and engineering design.

SUPPORTED BY U.S. National Science Foundation, Div. of Earth Sciences

5.0033, MEASUREMENT OF PHYSICAL AND INSTITUTIONAL FACTORS FOR MANAGING ENVIRONMENTS ON RURAL LANDS

R.S. FREEBURG, New Mexico State University, Agric. Experiment Station, Agricultural Engineering, *University Park, Las Cruces, New Mexico* 88070 (0072329; NM00609)

OBJECTIVE: Measure rates at which watershed characteristics change with development rates during the course of development of rural lands for recreation. Measure changes in water quality resulting from watershed characteristic changes. Assess patterns of development, considering institutional restraints, as to the expected effects on watershed characteristics.

APPROACH: Aerial photographs, in conjunction with information from county assessor, city and county zoning, and county clerk offices, will be used to determine change in amount and distribution of impervious surfaces within several types of recreational developments. From among developments studied, at least one of each type will be studied in more detail, measuring runoff in major watercourses within developed area, Coliform counts in perennial streams and/or wells where these exist, sediment concentrations in perennial and ephemeral streams which are being influenced by construction activity, water table levels in those areas where water table is near the surface, precipitation. Several construction designs will be computer-simulated for the developments studied and tested, considering institutional restraints, to predict a range of effects to be expected from each development. It will also take into account physical restraints such as topography of land, soil, access, vegetation, etc.

SUPPORTED BY New Mexico State Government

5.0034, GROUND AND TROPOSPHERE LOW-FREQUENCY EFFECTS

J.L. HECKSCHER, U.S. Air Force, Rome Air Development Ctr., *Griffiss Air Force Base, Rome, New York* 13440 (DF904160)

Technical objective - development of an in-house theoretical and experimental capability to predict and measure low-frequency radio propagation over irregular, inhomogeneous terrain. Development of techniques to determine earth characteristics which influence the ground wave. Inprovement of methods of incorporating physiographic data into the equations of ground wave propagation. Study effects of troposphere inhomogeneities on ground wave stability. Improve and extend VLF/ELF systems by identifying and measuring electrical noise caused by motion of aerospace vehicles through the troposphere. Refine new techniques for advanced detection of dangerous charge build-up in clouds, to improve lightning warning and to provide the basis for lightning damage avoidance systems.

The in-house theoretical capability will be accomplished beginning with existing residue series ground wave propagation equations for the smooth round earth formulated by van Pol and Bremmer, and used by Wait and Johler, and continuing with the integral equation approach development by Hufford and others. The equations will be cast into forms suitable for high-speed digital computation and numerical predictions for specific paths will be compared. The experimental capability will be realized with construction of equipment to transmit LF pulses having only one or two radio frequency cycles. In conjunction with existing digital receiving techniques, this short-pulse device will constitute a precision tool for the effort.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

5.0035, ORIENTATION, SURVIVAL, AND DISTRIBUTION OF ALFALFA WEEVIL POPULATIONS

J.R. MEYER, Univ. of North Carolina, Agric. Experiment Station, Entomology, *Raleigh, North Carolina* 27600 (0073236; NC05388)

OBJECTIVE: Analyze photodynamic properties of host plant recognition behavior and orientation in adult alfalfa weevils. Obtain data for activity and migration, and evaluate spectral preferences of adult weevils. Determine effect of temperature, desiccation, and time of year on weevil movements within and between alfalfa fields. Determine rates of parasitism. Characterize chemical structure of red head capsule filter used by adult weevils in remote-sensing of prospective host plants.

APPROACH: Collect alfalfa weevil larvae and adults with colored Leggett traps and sweep nets to provide data on migration and color preference. Make weekly measurements of adult flight activity on weevils exposed to 4 temp./humidity regimens. Examine weevils for parasitism. Collect and purify red cephalic filter pigment from recently emerged adults reared from larvae. Characterize pigment structure by chemical or physical analysis.

SUPPORTED BY North Carolina State Government

5.0036, HOME RANGE CHARACTERISTICS AND STATUS OF THE RED-COCKADED WOODPECKER (DENDROCOPOS BOREALIS) IN OKLAHOMA

J.C. LEWIS, Okla. St. Univ., School of Arts & Sciences, Zoology, *Agriculture Hall, Stillwater, Oklahoma* 74075

Evaluating the potential of using LANDSAT satellite imagery to identify habitat of the endangered red-cockaded woodpecker, and to determine the distribution and population size of the species in Oklahoma.

ADDENDA: This project is also supported by: Oklahoma Ornithological Society.

SUPPORTED BY Oklahoma State University

5.0037, PHENOLOGY, WEATHER, AND CROP YIELDS

G.W. PETERSEN, Penn. State University, Agric. Experiment Station, Agronomy, *201 Shields Bldg., University Park, Pennsylvania* 16802 (0069102; PEN02188)

OBJECTIVE: Use phenological and mesocale weather data to understand yield dynamics and to improve prediction of yield of selected agricultural crops.

APPROACH: Collect phenological data from indicator plants; relate to remotely sensed data with regard to acreage, crop condition and yield.

PROGRESS: A color television system that permits display of digital processing results is being used in land analysis. Data are analyzed on an IBM 370/168 computer over a dial-up-telephone line using an intelligent remote job entry terminal and displayed on a Ramtek color display system. Remotely sensed data acquired from the LANDSAT multispectral scanner and from optically scanned aircraft collected color infrared photography were input from digital tapes and processed to produce land use/land cover maps. Colors on the display are chosen dynamically by the operator allowing a display that is subjectively pleasing. The ability to alter colors while observing the display and the large number of colors available make this a very useful device to compare spatial relationships among different categories. Permanent copies of the display can be obtained in print or slide format by directly photographing the screen of the color display system.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Pennsylvania

5.0038, MILLIMETER RADIATION FROM ATMOSPHERIC GASES

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DESCRIPTION: The object of thhs research is to examine theoretically the radiation which would be received at a satellite from the resonant radiation of water vapor, oxygen and ozone.

The standard atmosphere is used to provide a model for the distribution of air temperature and pressure as function of elevation. The absorption and reradiation of radio wave by the atmospheric gases are calculated for each height above the earth's surface for frequencies including the millimeter wavelength resonance lines. Various angles from the nadir were considered as well as various elevations of the satellite. The effect of antenna beamwidth is also examined. Some computations for ground base observation are also done for the sake of comparison. These antenna temperatures measured from satellite can yield information above vertical distribution of atmospheric temperature.

Antenna temperature calculation for ozone is done for frequencies near 110.836 gHz. The reason why satellite-based-observation is necessary for sensing ozone is that detection of the ozone line by ground base observation is difficult because of overlapping of water vapor and oxygen emission lines. A parametric model for ozone distribution is assumed and variation of antenna temperature with changes in ozone concentration and height of maximum concentration is determined. In these calculations, radiation from the earth's surface and from the residuals of water vapor and oxygen lines is also taken into consideration.

SUPPORTED BY University of Texas

5.0039, REMOTE SENSING FOR IMPROVED SOIL AND CROP MANAGEMENT

H.W. GAUSMAN, U.S. Dept. of Agriculture, Agric. Res. Service, Soil Water Cons Res, *509 W. 4TH St., Weslaco, Texas* 78596 (0043802; 7202-20762-002)

OBJECTIVE: Develop procedures for spectrally measuring plant stresses due to nutritional status, salinity, soil moisture, temperature, pollutants, drainage conditions, and soil edaphic factors on fruit, vegetable, and field crops and rangeland; apply remotely sensed plant and soil condition information to improve their management.

APPROACH: Thermal patterns will be sensed with scanners and radiation thermometers to develop freeze prediction equations, assess damage to sugarcane and other crops develop cold protection systems and schedule irrigations. Color infrared photography and ground truth will be related to the health and yield of sugarcane, sorghum, citrus, and other crops. Laboratory and/or field spectral reflectance measurements, made periodically on normal and stressed crops and different crop genera, species, and cultivars, will be related to chlorophyll, water content, ground cover, and other factors to determine optimum wavelengths for detecting particular conditions and species' specific responses. Models describing the interaction of light with plant canopies and soils will be developed.

SUPPORTED BY U.S. Dept. of Agriculture, Agricultural Research Service, Subtropical Texas Area

5.0040, SEASAT-A COORDINATION AND APPLICATION

D.E. LICHY, U.S. Army, Coastal Engin. Res. Center, *Kingman Bldg., Fort Belvoir, Virginia* 22060 (31582)

OBJECTIVE: To coordinate the Corps needs with NASA activities with the SEASAT satellite for the development of remote sensing applications.

APPROACH: Evaluation and coordination of SEASAT-A application to the Corps needs by research, correspondence, attendance at meetings, participation in seminars and working groups and consulting with SEASAT groups of NASA, other sponsors, Corps Division and District offices, CRREL, WES, ETL, IWR and Division laboratories. This effort will match the potential capabilities of SEASAT-A with Corps problems and needs.

SUMMARY: The results of this work will be a continuing input of Corps needs and requirements for remotely sensed data on the coastal environment to NASA and development of a viable plan of attaining Corps goals using SEASAT data. It will result in application of the capabilities of SEASAT-A to the Corps needs for oceanographic data. This work will result in improved oceanographic data, ice monitoring, wave spectra and wind/wave interaction. This effort will satisfy needs for all coastal Districts as well as those of WES, CRREL, IWR, CERC and ETL for oceanographic data. Reports of progress and uses of data will be made for applications cited offices.

SUPPORTED BY U.S. Dept. of Defense, Office Chief of Engineers, Corps of Engineers

5.0041, MARINE LODE MINERALS EXPLORATION

J.R. MOORE, Univ. of Wisconsin, Inst. for Environmental Stud., *Agriculture Hall, Madison, Wisconsin* 53706 (R/GM-8)

OBJECTIVES: 1. To provide basic chemical, mineral and textural exploration clues that will indicate the presence of subseafloor lode bodies, particularly ores of copper, zinc, lead, nickel and barite. 2. To provide recommendations to industry for conducting integrated exploratory programs involving sedimentary indices, geophysical and remote sensing clues (if any) and the use of coastal extension projections in lode searches. 3. To provide

selected base line environmental surveys in the test areas, particularly in relation to turbidity. Initial field sites for this research will be Ellamar and Castle Islands and bays in southeast Alaska.

HOW INFORMATION WILL BE APPLIED: 1. Provide exploration aid to mining companies searching for copper, nickel, zinc, lead and barite in coastal/Outer Continental Shelf waters. 2. Provide recommendations to governmental agencies for developing lode mining regulations.

ACCOMPLISHMENTS DURING PAST TWELVE MONTHS: 1. Assembled and analyzed available data on depths, currents, bottom sediments and source rock geology at coastal research sites in southeastern Alaska. 2. Studied the nature and characteristic environments of mineral lodes at these sites. 3. Developed promising exploration clues for underwater deposits of barite and copper by mapping the location and relative concentrations of selected geochemical parameters - chiefly nickel, cobalt, silver, barium and copper. 4. Investigated the possibility that mineral grains revealed in thin-section petrography can yield clues to these mineral deposits. 5. A final report on this project will be filed before June 1, 1977.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Sea Grant Office

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, CRITERIA DEVELOPMENT FOR INSTRUCTOR/OPERATOR STATIONS

K.I. MEHRER, U.S. Air Force, Human Resources Laboratory, *Williams A.F.B., Chandler, Arizona* 85224 (DF223780)

To develop criteria for requirements of instructor/operator stations for various future aircraft flight simulators.

In the past, the efforts to determine the best instructor/operator station (IOS) configuration have been minimal, and the IOC design left to individual conjecture. The AFHRL/FT advanced simulator for pilot training (ASPT) has one of the most complete IOS designs with both a conventional IOS of switches and repeater instruments and an advanced/conventional IOS with two alphanumeric CRTs and two graphic CRTs with a keyboard control of the simulator. ASPT is presently configured as a T-37 and an A-10 which allows studies into trainer and fighter IOS design. Upcoming in CY78 is an aerial refueling project which can also be evaluated for tanker IOS requirements. Data defining the utilization of all developed ASPT advanced training provisions will be collected and reported in support of determining instructor station design requirements. Additional information will be generated by a questionnaire which will be developed and given to instructors and operators to evaluate which features of the IOS they use the most or least and any other comments they might make.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0002, MOLECULAR SIEVE OXYGEN GENERATION SYSTEM

J. RUDER, Garrett Corporation, *402 S. 36th St., Phoenix, Arizona* 85034 (DF323150; F33615-77-C-0620)

This effort will develop a breadboard breathing gas generation system based on molecular sieve concentration of ambient air. The system shall be used for test and evaluation of on-board oxygen generation concepts for USAF aircraft. The system should be lightweight, easily serviced assembly capable of providing a continuous supply of an appropriately oxygenated breathing gas mixture for one man in an aircraft cabin environment. Engine bleed air or its laboratory equivalent will service as the input air. The system shall be used primarily to investigate the effect of contaminated bleed air on unit performance.

The molecular sieve oxygen generation system (MSOG) should be capable of producing a 90 percent or higher oxygen enriched effluent over a delivery range of 5-50 liters per minute. The MSOG should be capable of operating with an input pressure and input temperature ranging from 5-200 psia and 70-300 degrees Fahrenheit. Respectively. the MSOG must have a variable cycle time capability for the adsorbent bed(s). Access panels to the adsorbent bed(s) are required for gas analysis on both the input and output sides of the bed(s). Normal operation should require a maximum of 100 watts power utilizing either 28 V DC or 110 V AC, 60 Hz.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0003, HUMAN HEAD AND NECK RESPONSE TO MULTI-AXIS ACCELERATIONS DURING MILITARY PARACHUTING

D.W. CALL, U.S. Navy, Natl. Parachute Test Range, *El Centro, California* 92243 (DN695430)

(A) To acquire multi-axis acceleration data from the head and first thoracic vertebra (t-1) from subjects performing military parachute jumps; (b) to determine the physiologic effects of these inertial forces; (c) to correlate these data with other studies of human responses to impact acceleration.

Naval test parachutists volunteers will be fitted with accelerometer mounts for the head and t-1. They will then wear these mounts with accelerometers while performing parachute jumps at the NatParachuteTestRan El Centro, using current fleet parachutes. Inertial and physiologic data will be transmitted to a ground receiving station during the entire egress and recovery event by a jumper-borne 17-channel FM/FM telemetry system. Analog tapes of this data will be sent to NavAeroMedRschLab DET-1 New Orleans for conversion to a digital format and computer assisted automatic data reduction and processing. Further data analysis and interpretation will then be performed by both organizations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Medical Research & Development Command

6.0004, MALE AND FEMALE STRENGTH MEASUREMENTS RELATIVE TO AIRCRAFT CONTROL ACTIVITY

R. BASON, U.S. Navy, Aviation Medicine Division, *Pensacola, Florida* 32512 (DN777267)

The primary purpose of this study will be to ascertain maximal strength capabilities for various cockpit controls for both males and females.

Fifty male aviation officer candidates and fifty females anthropometrically and age qualified for aviation from NAS Pensacola will be utilized for this study. Maximal strength capabilities for various control activities, i.e., yoke, stick, collective, rudder and canopy release will be determined for one minute duration.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Aerospace Medical Research Lab.

6.0005, EPISODIC HYPERTENSION ASSOCIATED WITH HUMAN BEHAVIOR

J.A. HERD, Harvard University, School of Medicine, Psychiatry, *25 Shattuck St., Boston, Massachusetts* 02115 (R01 HL 20364-01A1)

Physiological and behavioral studies of air traffic controllers will be conducted to determine how episodic elevations of arterial blood pressure are related to behavioral activities of air traffic controllers who are engaged in routine occupational tasks in familiar surroundings. Blood pressures and heart rates will be measured using portable recorders for indirect measurement of blood pressure in more than 300 subjects on four or five separate days over a four-year period. Intensity of work load will be determined according to the average number of aircraft controlled by each subject on many different occasions. Thus, each subject will serve as his own control and his own history of work performances will be used to gauge work intensity on specific days of observation. The behavior of each subject will also be measured. Individual characteristics of each subject will be determined using complete medical history, physical examination, laboratory tests, psychological questionnaires and interviews, personality assessment, life-change questionnaire, and job-satisfaction questionnaires. Levels of plasma cortisol, growth hormone, and

testosterone will be obtained in a collaborative study on the same subjects on different days. All of these data will be used to identify the physiological, psychological, and behavioral characteristics of air traffic controllers who respond to certain environmental events and occupational tasks with episodic or sustained elevations of arterial blood pressure.

SUPPORTED BY U.S. Dept. of Health Education & Welfare, National Inst. of Health, National Heart Lung & Blood Inst.

6.0006, SURFACE TEXTURING STUDY VIA PRN CODES
J.F. DESPAUTZ, Applied Digital Comm. Inc., *Morrestown, New Jersey* 08057 (DF228390; F33615-77-C-0068)

To explore the use of pseudo random noise codes for providing textural patterns on surfaces of various features. The effort shall explore utility of code patterns to provide varying degrees of granularity and the correlation of patterns from frame to frame in scene rendition. The potential of such patterns for representing real world textural renditions will also be assessed.

Various codes will be analyzed based upon those which provide differences in granularity and wide range of tonal variations. Two-dimensional surface features will be used and software will be developed to permit perspective displays to be generated. Display generation will be based upon fields of view and simulated altitudes typical of E/O sensor characteristics and mission profiles. The software shall have provisions that will enable both static and dynamic scene generation. Software will be deliverable and implemented at AFHRL/ASM facilities where scene evaluation will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0007, PERSONNEL TECHNOLOGY - DETERMINATION OF FUNDAMENTAL CHARACTERISTICS OF VISUAL SYSTEM FUNCTIONING AND INFORMATION PROCESSING
J.L. BROWN, Univ. of Rochester, Center for Brain Research, *River Campus Station, Rochester, New York* 14627 (DN623811; N00014-76-C-0189)

Determination of the effects of varying degrees of illumination, from very low to high intensity flash, on the effectiveness of visual information transmittal from naval aircraft and ship displays continues to be significant to accomplishment of the Navy's mission. This work unit is concerned with the study of aspects of pattern discrimination, color discrimination and visual acuity as they are relevant to the design and improvement of instruments for the visual display of information.

Planned research includes continuation of (1) psychophysical studies in man on the temporal and spatial resolution of the visual system, (2) electrophysiological studies in animals attempting to relate activity at various points in the visual system and cortical activity, and (3) development of an objective and rapid procedure for evaluating the presence and extent of color deficiency in humans.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

6.0008, GANGLION CELL RESPONSES FOLLOWING LASER EXPOSURE OF THE RETINA
M.L. WOLBARSHT, Duke University, School of Medicine, Ophthalmology, *Box 3711, Durham, North Carolina* 27706 (DF319770; F33615-77-C-0609)

To determine the extent of retinal area disrupted by lesion-producing laser exposures and correlate this with the time course of retinal function loss and recovery at energy levels less than those producing permanent lesion.

The use of the electrophysiological technique of recording from retinal ganglion cells will be made to evaluate laser exposure effects in the retina.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0009, APPLICATION AND REFINEMENT OF VISUAL SYSTEM MODEL
M.W. CANNON, U.S. Air Force, Aerospace Medical Res. Lab., *Wright Patt. A.F.B., Dayton, Ohio* 45433 (DF323810)

The objective of this work unit is the development of a predictive model of the human visual system and its application to the solution of Air Force problems in the following areas: (1) The development of a predictive model of human visual performance at selected visual recognition tasks such as alphanumeric symbol-set recognition or target recognition against a cluttered background. Such a model has great value in eliminating the need for time-consuming, expensive psychophysical testing to evaluate the fidelity of various display systems and the recognizability of various symbol fonts used in cockpit displays. (2) The development of bandwidth reduction schemes for image transmission optimally matched to the human visual system. (3) The development of size-and form-sensitive filters for target cueing or automatic target recognition.

The present algorithms for predicting human form recognition and similarity judgments will be tested against results of psychophysical experiments, in-house and from the literature, with emphasis placed on the evaluation of symbol-set recognizability and the development of a windscreen distortion measure. Bandwidth compression studies using various spatial frequency filters will be implemented on the AMRL/BBM pattern recognition facility and the usefulness of these filters will be tested by psychophysical experimentation on the filtered imagery. Results from this study will lead into the development of feature extraction filters for target cueing and automatic target recognition. The model itself will be continually improved by incorporation of pertinent results from the literature and from work unit 71842502, Visual Processes of Complex Imagery, being conducted by Miami University.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0010, CARDIAC CHANGES DURING ACUTE EXERCISE, EXERCISE CONDITIONING, AND GZ ACCELERATION
H.L. STONE, Univ. of Oklahoma, Graduate School, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (DF050410; AFAFOSR-3506-78)

AF function - aircrew personnel operating high-performance aircraft are exposed to increasing levels of rapid onset, sustained, repetitive maneuvering forces. It has been recognized that cardiovascular responses can be encountered which may be particularly important in determining performance and severely limit or restrict the capabilities of the aircrew. Deficiency - with the development and deployment of high-performance aircraft, flight personnel may be exposed to sustained periods of acceleration stress. Sustained gz acceleration has been shown to produce marked changes in human cardiac performance characterized by various arrhythmias and ECG abnormalities. These responses have been interpreted as suggesting possible hypoxic or ischemic insult to the myocardium. The miniature swine has been proposed as an animal model having similar cardiac anatomy to that of humans and, for this reason, has been used in experimental studies designed to determine the effects of acceleration stress on the heart. Objective -the overall goal of the proposed work is to define the cardiac responses of miniature swine to the high sustained Gz acceleration levels which will be encountered by man in high-performance aircraft during combat maneuvers. The major thrust of the current research is to identify the factor or factors leading to the cardiac responses previously observed in acceleration-stressed miniature swine. More specifically, the relative contributions of physiological factors (sympathetic nervous system) and/or mechanical stresses associated with Gz acceleration will be determined. How research contributes - the research is in direct support of RO 1.6, 'Mechanical Forces' and supplements ongoing projects at AMD.

After exercise conditioning and left stellate ganglionectomy, acceleration will be imposed to determine whether whose responses previously observed in acceleration-stressed swine can be prevented or reduced in magnitude. Cardiac responses will be evaluated on the basis of physiological, biochemical, and histological changes. The measurement of cardiac function, indices of

myocardial metabolism, coronary blood flow, and serum enzyme levels will provide information regarding the physiological status of the myocardium during acceleration stress. Long-term effects of repeated exposure to high sustained ts made in cardiac tissue.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0011, SATELLITE TECHNOLOGY IN BIOMEDICAL COMMUNICATION
V. MOSELEY, Medical Univ. of So. Carolina, School of Medicine, Medicine, *80 Barre St., Charleston, South Carolina* 29401 (N01OD82113 (CONTRACT NO.))

SUPPORTED BY U.S. Dept. of Health Education & Welfare, National Inst. of Health, National Inst. of Health Directors Office

6.0012, VALIDATION OF PERSONALITY INVENTORY TESTS FOR IMMEDIATE RISK FUNCTION OF AIRCREW MEMBERS WITH POTENTIAL CARDIOVASCULAR DISEASE
M. THOMAS, U.S. Air Force, School of Aerospace Med., *Brooks A.F.B., San Antonio, Texas* 78235 (DF321900)

This effort is part of an overall immediate risk function evaluation of aircrew members to identify those at high risk for a coronary event. The predictability of personality inventory tests will be defined and correlated with the immediate risk function probability of other risk factors. As a result of this work, a test will be defined for use in the general flyer population.

Personality inventory tests will be given to aircrew members who will be classified according to various personality types. The results will be correlated with the presence or absence of risk factors, clinical evaluations including coronary arteriography, and stress testing. This work was formerly documented under 7755-01-05.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0013, DEVELOPMENT OF METHODS FOR EVALUATION OF APPROPRIATE SKILL LEVEL REQUIREMENTS FOR AIRMAN JOBS
W.L. TITSWORTH, U.S. Air Force, Human Resources Laboratory, *Brooks A.F.B., San Antonio, Texas* 78235 (DF232000)

To develop methods for evaluating skill level requirements for a variety of established Air Force enlisted jobs, based on job content. This involves determination for several enlisted specialities of an efficient equation that maximizes prediction of skill level criterion values and whether such as equation can be applied to most enlisted specialties with an acceptable degree of confidence.

A factor rating procedure in combination with related data from occupational inventories will be used to provide a quantitative index which can be transformed to a skill level for any job based on the tasks being performed in that job. A feasibility study which provided reliable skill level predictions based on job content and responsibilities in two airmen career ladders will be examined and modified as appropriate, in order to extend the methodology to other ladders.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory ORE, Lackland AFB, Texas 78236

SUPPORTED BY U.S. Dept. of Defense, Air Force

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, SPECTRUM-RELATED COMPUTER STUDIES
UNKNOWN, U.S. Dept. of Defense, Electromag. Comp. Anal. Center, *Annapolis, Maryland* 21402 (FA70WAI-175; FA160312 (TRAIS NO.))

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

7.0002, VALIDATION OF A MATH MODEL FOR PREDICTING EFFECTIVENESS OF A HEAD/NECK RESTRAINT SYSTEM
T.J. ZENOBI, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN781473)

Technical objective - to develop a capability for predicting effectiveness of ejection seat restraint system designs under high acceleration pulses, i.e., ejection forces and crash forces. To utilize a computer math model for prediction of dynamic test results. To eliminate live subject tests at high loads by extrapolating data from low load tests with the math model.

Approach - Ejection tower tests using a human simulator with and without a head/neck restraint will be conducted. These tests will help determine effectiveness of the head/neck restraint as well as validate math model results. Paralleling this effort will be application of a computer math model for predicting ejection tower tests. Based on adequacy of results, extrapolation to g levels beyond those used in the tests will be performed and used to predict head/neck response to changes in head/neck restraint parameters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

7.0003, STATISTICAL ANALYSIS OF FLIGHT RECORDER DATA
D. WHITE, Vought Corporation, *P.O. Box 5907, Dallas, Texas* 75222 (DN790085; N00019-77-C-0464)

Investigate the existence of statistical relationships among measured flight parameters and flight stress spectra to allow more effective monitoring of aircraft structural life expenditure.

Analysis of multichannel flight data, containing measurements of flight parameters and strain at multiple airframe locations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, COMPILATION OF ATOMIC ENERGY LEVEL AND GROTRIAN DIAGRAMS FOR ALL STAGES OF IONIZATION FOR ALL ELEMENTS
S. BASHKIN, Univ. of Arizona, School of Liberal Arts, Physics, *Tucson, Arizona* 85721 (PHY76-22667 A02)

Financial assistance will be provided to support the continuation of a compilation of atomic energy-level and Grotrian diagrams. These diagrams will summarize present knowledge of the structure of each type of atom in each of its states of ionization.

This is a continuation of research currently supported under NSF Grant PHY76-22667 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0002, INVESTIGATIONS OF AN IDEAL CONFINEMENT CONCEPT AND ELECTRON-ION TWO-STREAM INSTABILITIES
A.Y. WONG, Univ. of California, School of Letters & Science, Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY77-07160 A01)

Research will continue on several topics of nonlinear plasma physics, including the formation of potential double layers, Buneman instabilities, and the interaction of cavitons. In addition, a new confinement system will be constructed and utilized, which will be a superconducting SURMAC device. This will approximate an ideal confinement system by eliminating most of the conventional plasma losses.

This work is a continuation of that currently supported under NSF grant PHY77-07160.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0003, NUCLEAR PHYSICS AND RELATED RESEARCH IN ASTROPHYSICS, GEOPHYSICS AND TECHNOLOGY
T.A. TOMBRELLO, Calif. Inst. of Technology, Graduate School, Physics Mathematics & Astron, *1201 E. California Blvd., Pasadena, California* 91109 (PHY76-83685 A01)

The research to be supported by this grant is in nuclear physics and related fields. It will be carried out in the Kellogg Radiation Laboratory, which has a history of significant contributions in these areas of research. The program covers many aspects of nuclear phenomena particularly as they relate to stellar processes and how the geological and astronomical record of elemental and isotopic abundances can be analyzed to elucidate their production mechanisms. The research activities are: nuclear physics and experimental nuclear astrophysics, theoretical nuclear astrophysics, nuclear geophysics and planetary science, atomic physics, and applied nuclear physics. These areas are closely related, and there is considerable interaction between the projects.

This research is a continuation of that currently supported by Foundation grant PHY76-02724 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0004, THEORETICAL HIGH-ENERGY PHYSICS
B.R. DESAI, Univ. of California, School of Physical Sciences, Physics, *Riverside, California* 92502 (PHY78-08423)

Research will be done in theoretical physics to further our understanding of the elementary particles.

Work will be done on a calculation of the mass spectrum of quantum chromodynamics. The investigators have developed a method for a systematic calculation of bound states of confined relativistic systems from the asymptotic behavior of gauge invariant Green's functions. The method is also applicable and has been tested for potential theory and will be applied now to the theory of strong interactions.

A detailed analysis of the shrinkage properties of differential cross-sections of various reactions will be done. This will be a test on the question of whether there are two distinct poles P and P' in the vacuum channel or only one as suggested by the Pomeron-f identity. It is also planned to analyze the properties of the central cluster in double-Pomeron exchange.

This work is a continuation of that currently supported under NSF grant PHY76-03676-A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0005, LIGHT SCATTERING STUDIES OF SPIN-FLIP PROCESSES IN SEMICONDUCTORS AND OF ANOMALOUS PHASE TRANSITIONS IN INSULATORS
J.F. SCOTT, Univ. of Colorado, School of Arts & Sciences, Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (DMR78-02552)

Experimental studies of Raman scattering in solids previously supported by DMR76-04561 will be continued. Spin-flip scattering experiments will be carried out on the wide bandgap semiconductors ZnTe:As, ZnTe:Li, SiC:Al; and SiC:N. Emphasis will be given to measuring the dependences of the transition intensities and linewidths as a function of concentration near the Mott transition. Raman studies of dynamics of the second order phase transitions in BaMn1-xCoxF4 also will be done. Related structural studies will be carried out for TbP5014 and Eu2SiO4. Three new effects will be emphasized in these studies: 1) ferroelectrically induced magnetism; 2) large dielectric anomalies proportional to sublattice magnetization near the critical temperature; and anomalous acoustic phonon dispersion at incommensurate transition temperatures.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0006, PLASMA PROCESSES IN SPACE
D. PAPADOPOULOS, U.S. Navy, Res. Laboratory, *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880025)

Understand the basic plasma mechanisms operating in the ionospheric and magnetospheric plasma, including ionospheric irregularities and their effects on electromagnetic wave propagation. Study the ionospheric and magnetospheric behavior and response resulting from both natural and artificial stimuli. Propose active experiments utilizing the ionospheric and magnetospheric plasma as an active medium for production of e-m radiation.

A combination of theoretical and computational techniques will be used. Isolated plasma processes of importance to the space environment will be studied by particle, Vlasov or non-linear mode coupling codes. Macroscopic phenomena and systems will be modeled with multidimensional multifluid codes with phenomenological transport coefficients.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0007, THEORETICAL LOW-ENERGY NUCLEAR PHYSICS
D. ROBSON, State University of Fla. Sys., School of Arts & Sciences, Physics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (PHY74-02673 A04)

Research initiated under NSF Grant PHY74-02673 AO1 will be continued. Topics in theoretical nuclear physics to be investigated include: Inelastic scattering (F. Petrovich): a) inelastic heavy-ion scattering; b) inelastic proton scattering; c) structure calculations; d) inelastic pion scattering. Nuclear many-body studies in the continuum (R. J. Philpott): a) continuum shell model calculations; b) three- and four-body problems; c) core plus two-nucleon model. Nuclear reaction studies (D. Robson): a) separable interactions in nuclear reactions; b) coupled reaction channels theory; c) exchange terms in heavy-ion scattering; d) four-nucleon transfer reactions and alpha-particle-like models. Direct reaction analyses with the exact finite-range DWBA computer code FANLU2 (Steve Edwards): a) DWBA cluster-charge exchange model for (HE3,t) reactions; b) (HE3, alpha) reactions in 1-p shell nuclei; c) other applications.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0008, FAST ION COLLISIONS WITH THIN FOILS AND SURFACES
H.G. BERRY, Univ. of Chicago, School of Physical Sciences, Physics, *5801 S. Ellis Ave., Chicago, Illinois* 60637 (PHY76-81060 A01)

Investigations will continue of atomic orientation and alignment induced by the interactions of fast ion beams with solids--both in transmission through thin solid foils and in reflection scattering from surfaces. Careful analysis of these proposed experiments will greatly aid in understanding the problem of the nature of the interaction of fast ions with solid surfaces.

This work is a continuation of that currently supported by NSF Grant PHY76-81060.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0009, SYNCHROTRON RADIATION STUDIES OF MATTER
F.C. BROWN, Univ. of Illinois, School of Liberal Arts & Sci., Physics, *Urbana, Illinois* 61801 (DMR76-20644)

High-resolution measurements of photoabsorption cross-sections will be extended to the carbon, oxygen, and nitrogen K edges in simple polyatomic gases. The experiments will be carried out using a new ultrahigh vacuum monochromator recently installed at the Stanford Synchrotron Radiation Project. The results will be compared with at threshold calculations of the highly excited states of molecules using ab initio theory. It is expected that the theory of extended absorption fine structures can be applied far above threshold. In addition, extreme ultraviolet

photoabsorption experiments will be carried out at the Physical Sciences Laboratory, Stoughton, Wisconsin. These will include studies of the selenium 3d-level absorption threshold in layer type titanium di-chalcogenide crystals with controlled transition metal excess.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0010, CTR PLASMA ENGINEERING STUDIES

G.H. MILEY, Univ. of Illinois, School of Engineering, Nuclear Engineering, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (E(11-1) 2218)

This research is concerned with various engineering aspects of fusion plasmas, including plasma dynamics and control, injection heating and fueling, energy multiplication, and fusion product effect. Much of this year's work has concentrated on fusion product transport. Methods to calculate orbits, drift and possible escape to the plasma vessel wall have been developed. The predicted bombardment profile in the wall will be tested against experiments now planned for Princeton's PLT device. This is a crucial problem relative to potential wall damage in local regions of high bombardment rates. Other aspects of the transport problem under study include shifts in the heating profile due to fusion-product drifts during slowing, plasma rotation created by electric fields induced by particle losses, and possible microinstabilities during particle slowing down.

SUPPORTED BY U.S. Dept. of Energy, Unspecified Unit

8.0011, ASTROPHYSICAL APPLICATIONS OF MICROSCOPIC AND MANY-BODY PHYSICS

D. PINES, Univ. of Illinois, School of Liberal Arts & Sci., Physics, *Urbana, Illinois* 61801 (PHY78-04404)

Research in theoretical astrophysics initiated under NSF grant PHY75-08790 AO2 will be continued. Topics to be investigated include: Fundamental Studies of Matter at High Densities; B. Physics of X-ray Sources; C. Dynamical Processes in Neutron Stars and Planets; D. Structure and Evolution of Degenerate Dwarfs; E. Other topics.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0012, X-RAY STUDIES OF SOLID-STATE PROPERTIES - VALENCE CHARGE DENSITIES AND ACOUSTOELECTRICALLY AMPLIFIED PHONONS

R. COLELLA, Purdue University, School of Science, Physics, *Executive Bldg., Lafayette, Indiana* 47907 (DMR77-27534)

Professor Colella's laboratory is developing techniques for inferring structural properties of solids from the diffraction of monochromatic X-rays. One part of the work is concerned with the nature of bonding in tetrahedrally coordinated semiconductors, specifically the III-V compounds. The details of the electronic structure, in particular the distribution of the valence (bonding) electrons, is open to question. To address this issue, Colella collaborators very carefully measure the intensities of quasi-forbidden X-ray diffraction peaks to infer the interatomic electron distribution. Extension of this work is concerned with the variation of bonding charge density as a function of applied pressure up to 100 Kbar in order to distinguish between effects due to thermal vibrations and changes in interatomic distances.

The second part of this work uses observation of satellite peaks on the wings of double-crystal X-ray diffraction peaks to observe acoustoelectrically amplified phonons (lattice vibrations). Use of this X-ray scattering technique permits study of crystals opaque to useful optical radiation. Under study are the anharmonicity of the acoustoelectric atomic vibrations; relation of anomalous transmission to momentum exchanged in the scattering process; and, use of time resolved experiments to discriminate between primary phonons and those generated through wall reflection and other processes.

This is a continuation of work supported under DMR 77-06744. It is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0013, IONOSPHERIC PLASMA TRANSPORT AT HIGH LATITUDES

M.J. MENDILLO, Boston University, School of Arts & Sciences, Physics, *881 Commonwealth Ave., Boston, Massachusetts* 02215 (DF248550; F19628-77-C-0019)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of plasma motions and the boundaries of trough and cusp precipitation regions as they respond to geophysical changes degrades capability of af navigation and communications systems. Objective - development of computer codes which allows modelling of response of plasmapause, cusp and trough poleward wall to changes in geophysical conditions. Compare these theoretical results with satellite data. How research contributes - provides improved capability of forecasting shifts of ionospheric regions such as the cusp and trough region as they respond to geophysical changes. These shifts severely deviate ray paths of Air Force navigation and surveillance systems including DSCS, AF SAT COM, 414I, and their improved prediction is urgently needed.

Study and apply computational techniques to modelling of plasma dynamics for calculations of boundary and dynamical responses to geophysical changes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

8.0014, SUPERGRAVITY, GENERAL RELATIVITY AND FIELD THEORY

S.J. DESER, Brandeis University, School of Arts & Sciences, Physics, *415 South St., Waltham, Massachusetts* 02154 (PHY78-09644)

Research in theoretical gravitation and field theory currently supported under NSF grant PHY76-07299 A01 will be continued. A major effort will be directed toward a deeper understanding of the new subject of supergravity. This theory attempts to unify the treatment of space, time, and matter into a single entity. Among the topics to be investigated are: 1. Supergravity; 2. Vector gauge fields; 3. Solitons; 4. Quantum gravity; 5. Classical gravity.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0015, A SEARCH FOR NEUTRAL CURRENT INTERACTIONS IN ATOMIC HYDROGEN AND DEUTERIUM

W.L. WILLIAMS, Univ. of Michigan, School of Lit. Sci. & The Arts, Physics, *Ann Arbor, Michigan* 48104 (PHY77-25712)

Research will continue to measure the coupling constants for the parity nonconserving (PNC) electron-nucleon interactions in atomic hydrogen and deuterium. The work of the last eighteen months has led to the development of a relatively high sensitivity microwave experiment to measure the nuclear spin-dependent electron-nucleon interactions. A study of systematic effects will also yield an experimental resolution to the outstanding controversy concerning the proper method of calculation with parity nonconserving, time reversal invariant theories when damping is present.

Further, as a result of these investigations, it has become clear that the electric regeneration experiment initially proposed must be carried out at much higher energies than originally anticipated. To this end and collaboration has been established with a group at the University of Windsor, where a 300 keV metastable hydrogen beam will presently be available.

This work represents a continuation of that currently supported by NSF Grant PHY76-02855 AO2 by a co-principal investigators W.L. Williams and Robert R. Lewis, Jr.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0016, SINGLE-PARTICLE AND PAIR-TUNNELING SPECTROSCOPY OF A15 SUPERCONDUCTORS

A.M. GOLDMAN, Univ. of Minnesota, School of Liberal Arts, Physics, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (DMR78-08513)

Single-particle tunneling experiments will be carried out on V3Si and V3Ge single crystals and on films of Nb3Ge, Nb3Sn and V3Si. Complementary specific heat measurements will be made. Pair-field susceptibility of single crystals will be studied to obtain the spectrum of fluctuations of the order parameter and to determine the degree of anisotropy. Single-particle and pair tunneling experiments will be conducted on single crystals near the structural phase transition. These studies are important for testing microscopic theories of superconductivity for these compounds and for determining the relationship between the structural and superconducting transitions. This is a continuation of work sponsored under DMR-7601370.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0017, CATOPTIC X-RAY OPTICAL SYSTEMS

J.F. MCGEE, St. Louis University, School of Arts & Sciences, Physics, *221 N. Grant Blvd., St. Louis, Missouri* 63103 (DF050630; AF-AFOSR-3480-78)

AF function - operation of high-altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand fundamental understanding of the various radiation processes occurring in plasmas. Deficiency - this aforementioned information required to design advanced equipment is not available today. Its acquisition may be realized by experimental work requiring advanced x-ray instrumentation. Objective - this project will perform theoretical and experimental research for the development of a compound catoptic x-ray microscope having both high resolution and large magnification. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beam), the development of space and ionospheric communications, and the development of countermeasures.

This project will perform theoretical and experimental research for the development of a prototype 'compound' catoptic x-ray microscope which will have high resolution and large magnification. This will accordingly reduce the resolution requirements of the recording film or associated x-ray image intensifier. It would be distinguished by its 'large working distance'. To reduce further the resolution to its theoretical limit a thorough understanding of the aberration coefficients peculiar to focusing x-rays at grazing angles should be developed. There is always the possibility of using one aberration coefficient to counteract another and thus achieve an overall reduction of aberrations and increased resolution. Earlier x-ray microscopes had a resolution limit of approximately 3,000 angstroms and a very limited field of view. Current research suggests that a resolution of 500 angstroms and a 2,000 micron field of view is possible. Confirming experiments in the long wavelength region (10 angstrom) are in progress.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0018, ACOUSTIC MAGNETIC RESONANCE STUDIES OF METAL HYDRIDES, BULK METALS AND PARAMAGNETIC INSULATORS

D.I. BOLEF, Washington University, School of Engin. & Appl. Sci., Physics, *4559 Scott Ave., St. Louis, Missouri* 63130 (DMR78-11567)

Acoustic magnetic resonance investigations of metal hydrides, bulk metals and semiconductors, and of magnetoelastic and spin-lattice relaxation effects will be carred out via nonresonant, (delta m equals O) interactions in paramagnetic systems. Special emphasis is placed on use of a high field superconducting magnet with homogeneity and sweep capabilities particularly suited for the investigation of metals and metal hydrides by nuclear acoustic resonance (NAR). These experiments will make use of the dynamic Alpher-Rubin coupling as well as dynamic quadrupole coupling mechanism. Particular areas that will be addressed are NAR of hydrogen via dipolar coupling in alpha, beta, and mixed phases of transition metal hydrides and NAR in single crystals of Be, Mg, and Ge.

This research was previously supported under NSF grant DMR-7680158, and DMR-7400360. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0019, ALIGNMENT AND ORIENTATION IN ATOMIC COLLISIONS

J. MACEK, Univ. of Nebraska, School of Arts & Sciences, Physics, *Lincoln, Nebraska* 68508 (PHY77-07110 A01)

Research initiated under NSF grant PHY75-07805 AO1 will be continued. Topics in theoretical atomic physics to be investigated include: 1. Spin polarization of hydrogen in H ion plus Xe collisions. 2. Coulomb-Born approximation. 3. Analysis of He ion plus He collisions and the Fano-Lichten model. 4. Orientation and alignment of the molecular orbital X-ray source. 5. Doubly excited state of helium. 6. Conversion of alignment and orientation in strong magnetic fields.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0020, MULTIPLE X-RAY DIFFRACTION EFFECTS IN SINGLE CRYSTALS

B. POST, Polytechnic Inst. of New York, School of Science & Engin., Physics, *333 Jay St., Brooklyn, New York* 11201 (DMR77-02532 A01)

This investigation will be a study of the nature and techniques of multiple diffraction of X-rays by crystals, and the application to selected problems in materials science and solid-state science. The study will include highly precise lattice constants of crystals such as gallium arsenide, gadolinium gallium garnet, and magnetic oxides.

In addition, the experimental determination of phase relationships among X-ray reflections from single crystals will be made. This will be done by analyses of the intensity distributions in the X-ray fine structure of reflections recorded under conditions of multiple diffraction. The research will be broadened from the study of perfect crystals to less perfect crystals.

This is a continuation of research initiated under NSF Grant DMR75-23680.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0021, THEORETICAL RESEARCH IN CONDENSED MATTER PHYSICS

V. AMBERGAOKAR, Cornell University, School of Arts & Sciences, Physics, *Ithaca, New York* 14853 (DMR77-18329)

This research was previously supported under grant DMR-7423494.

Theoretical research will be carried out on a wide range of topics in condensed matter theory. Among the probems which will be considered are: (1) Non-equilibrium effects in superconductors. (2) Chemical Kinetics. (3) Superfluidity of liquid 3He. (4) Dense Conducting fluids, especially their behavior near the liquid-vapor transition; (5) Optical properties of metallic systems, including generalizations to electron energy loss phenomena. (6) Photoemission, including an attempt to understand the microscopic fields near surfaces and how they may bear on the interpretation of angle integrated and angle resolved photoemission. (7) Zero temperature freezing and melting of Bose and Fermi systems. (8) Exact simulations of bulk helium four in both solid and liquid phases. (9) Surface and bulk singularities in the A-phase of 3He, their topological necessity and their bearing on the stability of superflow. (10) Local moment/valence fluctuation systems. (11) Transport processes across a liquid 3He-solid interface. (12) Low temperature properties of solid bcc 3He.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0022, FIELD-REVERSING ELECTRON AND ION RINGS FOR THE CONFINEMENT AND HEATING OF PLASMAS

H.H. FLEISCHMANN, Cornell University, Lab. of Plasma Studies, *Ithaca, New York* 14850 (EY-76-2-02-2319)

OBJECTIVE: The program is aimed at an experimental and theoretical study of the prospects of various fusion schemes using 'coils' of high energy charges particles trapped within the fusion plasma itself for the confinement and heating of this plasma.

SCIENTIFIC BACKGROUND: Theoretical predictions and the results of a number of CTR experiments indicate superior confinement characteristics of minimum-B or near-minimum-B configurations, as they can be generated by such internal current rings. If successful, such a scheme could lead to sizeable reductions in the reactor volume and the necessary magnetic fields in a final fusion reactor. Also, the heating of the plasma could be improved.

RESULTS: Field-reversing electron rings (self-fields up to 190% of applied mirror field) have been generated in three different experiments, most recently also by 'stacking' of two weaker rings. The lifetime of the field-reversing state has now been extended to almost 500 microsec in the RECE-Christa device. Although faster-than-classical fast-electron losses are observed in some cases, the decay of three rings in most cases appears dominated by classical scattering of the fast electrons.

Good gross stability is indicated by various results. Rings in the RECE-Christa have been moved axially over about 1.6 m. Additional fast-electron losses occurring in quadrupole-aided mirror fields in the RECE-Berta have been traced to orbital instabilities which may become important also in machines. Time-integrated ion beam densities in magnetically insulated diodes have now reached the values required in ion ring experiments.

SUPPORTED BY U.S. Dept. of Energy, Div. of Magnetic Fusion Energy

8.0023, DATA ACQUISITION SYSTEM FOR MAGNETIC RESONANCE LABORATORIES

R.H. SILSBEE, Cornell University, School of Arts & Sciences, Physics, *Ithaca, New York* 14853 (DMR78-04398)

Signal Averaging equipment with some peripheral items will be provided to automate the data collection for the electron spin resonance (ESR) laboratory at Cornell. This new equipment will be especially useful in data averaging over successive rapid scans of the applied magnetic field and will improve the resolution of the existing ESR equipment considerably. This equipment will be used for investigations of the spin dynamics and fluctuations of magnetic ions along polymer chains and to determine the exchange and crystal field effects in the electronic states of these ions. Transmission ESR will also be used to study the electronic states and their relaxation times in a variety of metals and thin metallic films.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0024, PHYSICAL PROPERTIES OF NARROW SUPERCONDUCTING FILMS AND ARRAYS

Y. KAO, State University of New York, School of Arts & Sciences, Physics, *Stony Brook, New York* 11790 (DMR77-04511 A01)

This research is a continuation of work begun under NSF grant No. DMR73-07494. The properties of superconducting microbridges, Josephson junctions and arrays of Josephson junctions will be studied in order to develop sensitive radiation detectors. Computer-controlled electron-beam lithography will be used to fabricate superconducting microbridges which range in size from a few thousand angstroms to a few microns. The physical properties of individual bridges will be studied and a special emphasis will be placed on the coupling between adjacent bridges. Measurements will be made to study non-equilibrium effects and the dynamics of superconducting pairs in arrays of Josephson junctions. A primary goal of the research is to understand the coherent properties of arrays of weakly coupled superconductors.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0025, MODEL SYSTEMS

B. MCCOY, State University of New York, School of Arts & Sciences, Physics, *Stony Brook, New York* 11790 (DMR77-07863 A01)

Continuation of research supported by DMR-75-10746.

The research will consist of theoretical investigations of systems which have infinite degrees of freedom. The particular systems of interest are the two-dimensional Ising model and relativistic quantum field theory (in particular the Yang-Mills theory with a Higgs mechanism). For the two-dimensional Ising model, it is proposed to extend the extensive calculations on 2 spin correlations and the fragmentary calculations on 3 and 4 spin correlations to the general case of spin correlations. With these results it will be possible to study analytically the equation of state of the two-dimensional Ising model. It is also propossd to extend some of the work on the 2 point functions from T near Tc to arbitrary temperature. This will be useful in studying the momentum distribution of the one dimensional gas of impenetrable bosons. For the quantum field part of the proposal, it is intended to extend the previous work on the s yields infinity fixed t behavior of Yang-Mills theory from the present leading order results by retaining enough of the higher order terms (which so far have been dropped) to obtain a result which is unitary and in particular that will satisfy the Froissart bound (which the leading order results do not).

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0026, PHOTOPION REACTIONS IN COMPLEX NUCLEI

J.E. WINHOLD, Rensselaer Polytechnic Inst., School of Science, Physics, *110 8TH, Troy, New York* 12181 (PHY77-09408 A01)

A program of photopion production studies at the Bates Linear Accelerator (MIT) will be continued in collaboration with Boston University and MIT. The program will emphasize observation of charged pions and measurement of differential cross sections for specific final nuclear states. Initially a low-energy pion spectrometer completed in 1976 will be used to cover a pion energy range from 10 to 45 MeV with 1 MeV energy resolution, extending recently published measurements on carbon-12 to a variety of other nuclei. Lithium-6, carbon-12, carbon-13 and oxygen-16 will be used as targets for studies of the production cross sections for positive and negative pions; searches will be made for production of giant multipole resonances, especially electric and magnetic dipole resonances; measurements will be made of pion production on very light nuclei, especially deuterium and helium-3. Towards the end of the three-year program it is hoped to initiate measurements with a new and larger spectrometer now being planned at MIT which will permit studies at higher energies.

Analysis of the data is expected to provide new insight into the interaction between pions and nuclei, and to provide new types of information concerning nuclear structure and transitions.

This work is a continuation of that performed under Foundation grant PHY76-14909.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0027, WAVE PROPERTIES OF HETEROGENEOUS MATERIALS

R.L. MILLS, Ohio State University, School of Math. & Phys. Scis., Physics, *164 W. 17th Ave., 102 Administration Bldg., Columbus, Ohio* 43210 (DMR78-11770)

Research previously supported by DMR76-10846.

Theoretical research in condensed matter physics will be carried out. The main emphasis will be on the properties of heterogeneous materials. Some of the topics to be investigated will include: (1) The propagation of mechanical waves in composite media. (2) The determination of elastic moduli of porous solids. (3) The development and application of a generalization of the coherent potential approximation, known as the 'traveling cluster' approximation. (4) The application of multiple-scattering theory to electromagnetic wave propagation in composites.

This research will enhance the understanding of heterogeneous materials, such as metallic alloys, multiphase solids and composite materials of geophysical and metallurgical interest.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0028, X-RAY DIFFRACTION STUDIES OF THE STRUCTURE OF LIQUID CRYSTALS

A. DEVRIES, Kent State University, Liquid Crystal Institute, *Hilltop Dr., Kent, Ohio* 44242 (DMR76-21364 A02)

The principal aim of x-ray diffraction studies of liquid crystals is to arrive at a better understanding of the structures of the various phase types on a molecular level. Within this general context, two research projects are under way.

The first project is a detailed study of the structure of a 'single crystal' of a smectic H phase, using techniques generally used for the study of crystal structures of solid single crystals. It is expected to show whether the molecules in the smectic H phase are rotating (as is often being assumed), and it may help in understanding the difference between a smectic H phase and the corresponding solid crystal phase.

The second project aims at determining whether certain optically uniaxial smectic phases have, in fact, optically biaxial smectic layers and owe their overall optically uniaxial character to a random stacking of these biaxial layers. The existence of such phases could have impact on the classification of smectic phases and on the general understanding and interpretation of their structures.

This is a continuation of research supported under DMR-74-13173 and is the first year of a 2-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0029, THEORY OF SOLIDS

G.H. WANNIER, Oregon State Higher Educ. Sys., School of Liberal Arts, Physics, *1472 Kincaid St., Eugene, Oregon* 97401 (DMR77-06736 A02)

Continuation of research supported under DMR76-18880.

The theoretical problem of a crystal in a magnetic field will be investigated. This problem has not yet been solved rigorously, but some approximate solutions are known and some group-theoretic properties have been established. These approaches will be examined and extended.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0030, ULTRASOUND STUDIES OF CONCENTRATION OR CRITICAL FLUCTUATIONS IN LIQUID BINARY SYSTEMS WHICH EXHIBIT A METAL-NONMETAL TRANSITION

D.E. BOWEN, Univ. of Texas, School of Liberal Arts, Physics, *El Paso, Texas* 79902 (DMR78-08494)

The broad goal of this work is to understand what factors govern the transition of a substance from a conducting state at higher temperatures to a non-conducting state at a lower temperature. This transition is called a metal-nonmetal (MNM) transition and is of broad interest in condensed matter science. The attenuation and velocity of ultrasound through solutions of alkali metals in liquid ammonia are measured as functions of temperature near the critical point. The data are analyzed using Fixman-Kawasaki theory to infer correlation lengths and, perhaps, scaling parameters.

This is a continuation of work supported under DMR 75-23652.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0031, ELECTRONIC TRANSPORT PROPERTIES OF CERAMIC AND SINGLE-CRYSTAL TITANIUM DIOXIDE

O.W. JOHNSON, Utah Higher Education System, School of Science, Physics, *1400 &. 2ND S., Salt Lake City, Utah* 84112 (DMR76-82077 A01)

The present studies are expected to characterize completely the electronic properties of both single-crystal and ceramic rutile (titanium dioxide). Measurements in the range above 300 degrees C yield directly the drift mobility over the range from 300 degrees K to 1,000 degrees K (or possibly higher). Since impurity scattering is negligible in this range, the measured mobility is that characteristic of the lattice (at least in the single crystals). Below room temperature, conductivity measurements are supplemented by measurement of the Seeback coefficient and of transient photo-conductivity to give impurity scattering as well as the effects of point defects and grain boundaries.

In addition to the conduction band transport studies, the problem of impurity band conductivity is examined. Techniques have been developed for controlled doping with acceptor impurities such as Al and Fe. Subsequent (lower temperature) doping with H, which acts as a simple donor, permits a detailed study of impurity band conduction, where both the impurity band parameters (determined by acceptor concentration) and the 'filling' of the band (determined by H concentration) can be systematically varied.

Ta-doped ceramic rutile shows promise for a variety of applications. Thus, this series of studies may be of practical importance. It is expected to contribute also to understanding of polaron properties, impurity band phenomena and the relationship between single-crystal and polycrystalline transport properties.

First year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0032, DISLOCATION DYNAMICS

J.W. MITCHELL, Univ. of Virginia, School of Arts & Sciences, Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR77-26168)

This is a continuation of a fundamental investigation on the motion of high velocity dislocations in solids. The objective is to understand the origins of resistance to the motion of individual dislocations from a theoretical and experimental point of view. Studies on Cu-Ni-Pd-Al alloys which have relatively high yield points due to solute segregation at residual dislocations, and yet have an apparent low fractional resistance to dislocation motion will be continued. The dislocation velocities as a function of temperature (4.2 degrees to 300 degrees K) and applied stress will be determined for single crystals of these alloys, as well as for single crystals of Cu-Ni and Cu-Al-Ni alloys surface hardened by diffusion of Pd into the surface layers. Supplementary studies required to establish the detailed dislocation mechanisms of the relaxation processes will be done. Current research on the lattice dynamical theory of dislocation motion will be continued with particular emphasis on the velocity range half the speed of sound, where low stress long-range motion of straight dislocations has been shown to occur in simple lattice models. In addition, a detailed study of the interaction of moving dislocations with phonons, with the aim of establishing a theory of the temperature dependence of dislocation mobility will be undertaken, and will include the effect of dispersed impurities in a non-dilute alloy. Lastly, theoretical studies on the propagation of dislocation avalanches and microcracks will be undertaken. This is a continuation of research, previously funded under NSF Grant DMR76-01059. This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0033, OPTICAL AND ELECTRON SCATTERING SPECTROMETRY OF SOLIDS

S.E. SCHNATTERLY, Univ. of Virginia, School of Engin. & Appl. Sci., Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR77-21709)

This is the second year of research on optical and electron scattering studies of solids supported by NSF continuing grants DMR76 19852 and DMR76 18667. The fast electron inelastic scattering spectrometer built with NSF support will be used to investigate single particle and collective excitations in solids. Work on plasmons in simple metals and other solids will be continued. The present studies of lithium, sodium and aluminum will be extended to other simple metals and to carefully chosen semiconductors and insulators. Further work will be done on the momentum transfer dependence of soft x-ray absorption thresholds in simple metals. Also, the recent proposal that certain features in

the x-ray absorption spectra of atoms are true collective effects or atomic plasmons is being actively pursued. Optical experiments will be done using the recently constructed infrared ellipsometer. The instrument will be tested by measurement of the optical properties of gold. Then transferred metals will be studied in order to test the proposed relation between infrared optical properties and superconducting transition temperatures.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0034, QUANTUM THEORY OF REACTIVE, DISSOCIATIVE AND INELASTIC MOLECULAR SCATTERING
K. TANG, Pacific Lutheran University, School of Arts & Sciences, Physics, *P.O. Box 2068, Tacoma, Washington* 98447 (CHE78-09808)

Professor Tang's grant is for research in the quantum chemical area of atom-molecule scattering. The fundamental process occurring in chemical reactions is the collision between atoms and/or molecules of reagents, with subsequent rearrangement of chemical bonds to form products. Tang's group will seek to develop a polarized target coupling method for three dimensional reactive, dissociative, and inelastic molecular scattering. This work will be an extension of the adiabatic distorted wave model already developed by Tang and others. By relaxing the adiabatic assumption, it will become possible to treat reactive scattering processes with small or no activation barriers. Convergence of results will be tested in a systematic way, and formal aspects of the theory will be studied. Attention will be focussed on reactions involving hydrogen isotopes, because of their fundamental theoretical interest, and on reactions involving hydrogen halides, because of their importance in laser applications. Calculations on cross sections of ion-molecule collisions will be carried out in order to shed light on the process of vibrational enhancement of reaction rates. Similar techniques will be used to investigate ways to predict the outcome of dissociative scattering processes, as well as to develop efficient quantum methods for calculating inelastic cross sections for vibrational-translational-rotational energy transfer.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

8.0035, THEORETICAL STUDIES OF THE MAGNETIC PROPERTIES OF SOLIDS
D.L. HUBER, Univ. of Wisconsin, School of Natural Sciences, Physics, *Agriculture Hall, Madison, Wisconsin* 53706 (DMR77-01057 A01)

Theoretical investigations will be carried out on problems where the local spin picture is appropriate. These include a study of the low-frequency critical spin dynamics in rare-earth systems with singlet ground states, and also the study of the long-wavelength collective modes in spin glass alloys. These studies will be carried out using archetypal spin Hamiltonians (Heisenburg, Ising, etc.) and will be related to experimental data for systems which are well represented by such Hamiltonians. The relationship of the spin dynamics to magnetic critical phenomena will be examined.

This is a continuation of NSF Grant DMR72-03014.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, STELLAR PROPER MOTION SURVEY WITH THE 13-INCH PHOTOGRAPHIC TELESCOPE OF THE LOWELL OBSERVATORY
H.L. GICLAS, Lowell Observatory, *P.O. Box 1269, Flagstaff, Arizona* 86001 (AST77-25117)

The purpose of the investigation is to discover and identify faint stars that are moving at a high rate of speed across our line of sight, i.e., large proper motions. This implies that they are relatively close and therefore, merit further, more detailed investigation by many different astronomical disciplines in order to gain more insight into stellar evolution and the structure of our own Milky Way system.

High-quality homogeneous photographs made at Lowell Observatory 48 years ago will be compared with similar photographs made with the same telescope today. The yearly photographs were obtained in the search which led to the discovery of Pluto--the outermost planet in the solar system--in 1930. Funds are for the continuation of this program in the southern hemisphere to -30 degrees declination and to republish the identification charts from the first one hundred regions for which the supply has been exhausted. Also, a summary catalog of motion stars measured to date in the southern hemisphere will be published. An estimate of the color is made from a comparison of the blue plate with a red one of each star, and finding charts are prepared.

Prior support was by NSF grant AST 76-08470 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0002, PLANETARY VOLCANISM AND TECTONISM
B.K. LUCCHITTA, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *601 E. Cedar Ave., Flagstaff, Arizona* 86001 (8-9580-01329)

Regional deformation of lunar mare surface (D.H. Scott): The study proposes to measure the amounts of deformation of mare surfaces from assumed initial planar attitudes of deposition, to determine the probable cause of warping, and to estimate the degree to which isostatic adjustment has been attained.

Scarps and ridges on the Moon and Mars (B.K. Lucchitta): Proposed is a continuation of a detailed investigation of mare ridges and highland scarps on the Moon along the Apollo ground tracks, where geophysical and geochemical data can be combined with interpretation from high resolution photographs; and a general investigation of mare-ridge like structures on Mars seen on Viking images. The aim of the study is to broaden our knowledge of a process that appears to have affected plains on all known terrestrial bodies whose early surfaces are preserved.

Lava flows on the Moon, Mars, and Mercury (G.G. Schaber, H.J. Moore, and D.W.G. Arthur): Planned is a continuation on the comparison of lava flow surfaces on the Moon, Mars, and Mercury, and flows of impact melts and debris on the Moon. Results of quantitative studies of the rheological properties of flows on the Moon, Mars, and Mercury will be analyzed, integrated, and compared with the objective of learning about the differentiation of planetary bodies and flow behavior under diverse gravitational and atmospheric conditions.

Small scale volcanic features on the Moon, Mars, Mercury, and Earth (C.A. Hodges): The objectives are to survey the different morphologic types represented by cones and domes in the San Francisco volcanic field and determine the factors which govern their diverse shapes and modes of eruption; to develop criteria for extrapolating results of the field investigation to morphologically similar extraterrestrial structures; to reexamine those constructional features on the Moon which have been interpreted as volcanic; and to interpret probable compositions, modes of eruption, ages, geologic settings, and other characteristics of extraterrestrial structures.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

10.0003, LUNAR CONSORTIUM
L.A. SODERBLOM, U.S. Dept. of The Interior, Geological Survey, Geologic Div, *601 E. Cedar Ave., Flagstaff, Arizona* 86001 (9580-01327)

The research emphasis of the program described here is focused on specific lunar geoscience problems, whereas in previous years the research was centered on creation of a digital library containing a vast amount of lunar orbital and earth-based remote sensing data. The program does contain some continued experimental work in developing array processing techniques, new correlation methods, and augmentation of the existing Consortium library. These are added as specific tasks to the following list of geoscience tasks: (1) Mare Chemistry: Correlations among Gamma-ray, Colorimetric and X-Ray Data, (2) Mare Topog-

raphy: Correlations with Age and Chemistry, (3) Analysis of New Global Colorimetric Maps, (4) Geologic Map of Lunar Maria - A Synthesis of Remote Sensing Data, (5) Correlations in the Highlands: Chemistry and Geophysics, (6) Correlations Between Global Provinces and High-Resolution Ground Track Studies, (7) Correlations of Radar Data with Mare Age Chemistry and Albedo, (8) Augmentation of Consortium Digital Library, and (9) Experimental Research in Correlation Techniques.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

10.0004, A SENSITIVE NEAR-INFRARED PHOTOGRAPHIC SKY SURVEY
E.R. CRAINE, Univ. of Arizona, Steward Observatory, *Tucson, Arizona* 85721 (AST76-19832 A01)

A wide-angle, high-resolution photographic survey of the entire northern sky will be carried out in near infrared wavelengths at high sensitivity (very deep limiting magnitudes). In the past, photography of this type was severely constrained by very slow photographic emulsions. A new and innovative approach will be used by applying the technology of high-gain, red-sensitive electronic image intensifiers to the problem of survey photography. The survey will be comparable in resolution to the widely used, shorter wavelength National Geographic Society-Palomar Observatory Sky Survey (NGS-PSS). The near infrared region of the spectrum will be used to avoid hydrogen emission features which 'black out' large regions of the sky on the NGS-PSS red plates. Huge new regions of the 'infrared' sky which have never been seen before will be investigated scientifically. In addition, the survey will 'look' through dust regions which obscure much of the galactic plane. The survey will provide an exciting new look at our galaxy and universe and will serve as a valuable complement for existing sky surveys undertaken at other wavelengths for problems of galactic and extragalactic astronomy.

This is a continuation of research done under grant AST 76-19832.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0005, INVESTIGATIONS OF THE COSMOLOGICAL CONSEQUENCES OF ANTIMATTER
H. ALFVEN, Univ. of California, Graduate School, Applied Physics & Info Science, *P.O. Box 109, San Diego, California* 92037 (AST76-15521)

The theoretical investigation of the consequences of Klein's hypothesis that the universe contains large amounts of antimatter will be carried out. The role of antimatter in cosmogony, including methods whereby it can be separated, and the scale of that separation will be explored. The observable consequences having matter and antimatter interacting and the relation of the cosmic X-ray background and recently observed sporadic cosmic X-rays will be considered. The cosmic X-ray background may arise from interpenetrating gas, and the sporadic X-rays may be caused by the collision between condensed normal and antimatter.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0006, COMPOSITION AND STRUCTURE OF COMETS
D.A. MENDIS, Univ. of California, Graduate School, *P.O. Box 109, San Diego, California* 92037 (AST77-19879)

Support is to continue a theoretical research program on the composition and structure of comets to be concerned mainly with: (a) The physical and dynamical processes in cometary atmospheres and ionospheres and tails. (b) The comet-solar wind interaction, including the structure and stability of the interface between the cometary and solar wind plasmas. (c) Morphology and generation of the cometary magnetic fields and associated currents and their effects on the plasma dynamics of the ionosphere and the tail. (d) Physical properties of non-volatile ('dust') component of comets and inferences regarding its chemical composition. (e) The study of the interaction of the cometary dust and plasma with a view of extending the study of dust tails.

Prior support was by NSF grant AST 74-23501.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0007, FREQUENCY OF LATE-TYPE BINARY STARS
W.I. BEAVERS, Iowa State Univ. of Sc. & Tech, School of Hum. & Sciences, Physics, *Beardshear Hall, Ames, Iowa* 50010 (AST76-10140 A01)

Renewal support is for a program of rapid, high-quality photoelectric radial velocity measurements using a Griffin-type mask. Under prior support in the eight-month interval of April 1976 through November 1976, approximately 1,140 stellar radial velocity measurements have been obtained with the Fick Observatory 24-inch telescope and coude spectrograph. Such a dedicated instrument supplies valuable information concerning velocity variability and thus contributes significantly to a wide range of stellar subjects. The main objective is the determination of the frequency of binaries among nearby late-type dwarfs. Additional goals are the determination of radial velocity curves for numerous objects with previously suspected variability and definitive observations at crucial times for visual binary orbits. About 3,000 additional measurements are expected to be obtained in the second year.

Prior support was by NSF grant AST76-10140.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0008, LONG BASE LINE INTERFEROMETRY OF THE SUN AT CENTIMETER WAVELENGTHS
M.R. KUNDU, Univ. of Maryland, School of Engineering, Physics & Astronomy, *College Park, Maryland* 20740 (ATM76-22415 A01)

This grant will continue the use of long base line interferometers to observe the fine structure of the radio emissive regions on the Sun at centimeter wavelengths. The observations will be devoted to the study of the fine structure of the quiet Sun such as limb brightening and spicules, of active regions and of flare-associated burst sources. Such studies will be important for models of the chromosphere and for understanding the mechanism of generation of radio emission from active regions and flares. Several interferometers will be used for this study: the NRAO (National Radio Astronomy Observatory) four-element interferometer at 3.7 and 11.1 cm, the Hat Creek interferometer at 1.3 cm, the Stanford five-element array at 2.8 cm, and the Westerbork synthesis radio telescope at 6 and 21 cm. In particular, the Westerbork telescope will be used in an attempt to synthesize super-granulation networks at 6 cm. It will also be used to study the structure and position of the sources that produce transient brightenings of a few minutes' duration.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

10.0009, GALACTIC AND EXTRAGALACTIC RADIO ASTRONOMY
B.F. BURKE, Mass. Inst. of Technology, Graduate School, Physics, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (AST77-26896)

Studies of galactic structure and the interstellar medium will be carried out in a broadly-based program of spectroscopic and continuum radio observations. Very Long Base Line Interferometry (VLBI) observations will concentrate on the study of hydrogen (OH), water (H2O) and silicon oxide (SiO) masers with the aim of determining their structural changes, motions, and detailed structure. The eventual goal is the understanding of the maser mechanisms and the process of star formation. Earlier research on the detailed structure of the nuclei or radio galaxies will be continued. Conventional interferometry will be used to study the structure of galactic supernova remnants and ionized hydrogen (HII) regions using the aperture synthesis interferometer and the Very Large Array (VLA). In addition, a new VLA program will be pursued to study the detailed excitation temperatures of high-velocity clouds. A cooled 7 mm wavelength radiometer now under development will be tested and used for single-dish observations of galactic sources. VLBI methods will be developed for use at millimeter wavelengths. The principal aims

of the research will be to understand the physical processes acting in the interstellar medium, interstellar masers, and nonthermal radio sources, and to relate these to processes of galaxy and star formation.

This is a continuation of grant AST 73-05043 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0010, A SEARCH FOR SPHERICAL HALOS SURROUNDING SPIRAL GALAXIES

D.J. HEGYI, Univ. of Michigan, School of Lit. Sci. & The Arts, Astronomy, *Ann Arbor, Michigan* 48104 (AST76-22109 A01)

A new photometric instrument, an annular scanning photometer (ASP), has recently been used to detect an optical halo surrounding the giant spiral galaxy NGC 4565. The halo is visible out to a distance of 34 kpc from the plane of the disk, a distance equal to 63 per cent of the optical disk radius visible on the Palomar Sky Survey red prints. At this distance, the halo surface brightness was 1 part in 1,000 of the night sky in the spectral band of the instrument. Based on some preliminary V-I photometric data and the lack of other possible sources for the optical emission, it was concluded that the halo is composed of K7 or redder type stars and may be quite massive.

Observations will be extended to other galaxies and to obtain measurements out to greater radial distances. Most significantly, it will be attempted to determine the mass in halos. To do this, it will be necessary to conduct a major program in multicolor photometry. At this time the ASP is the most suitable instrument for this program.

This is a continuation of research done under grant AST 76-22109.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0011, OBSERVATIONS OF EXTRAGALACTIC SUPERNOVAE

R.P. KIRSHNER, Univ. of Michigan, School of Lit. Sci. & The Arts, Astronomy, *Ann Arbor, Michigan* 48104 (AST77-17600)

An organized effort will be made to obtain supernova spectrophotometry, using the new 2,000-channel reticon scanner at the 1.3 meter telescope of the McGraw-Hill Observatory. Spectral scans with 10% absolute accuracy over the wavelength interval 3500-8000A and 5A resolution would be made for every supernova brighter than 17th magnitude. In a typical year, this should be about 9 supernovae. Observations will be repeated with a frequency that emphasizes the early expansion of the photosphere, but does not omit the time when the photosphere begins to turn transparent, or the behavior long past maximum light.

The data will be useful in three principal ways. First, the statistical investigation of supernova rates and magnitudes depends on establishing the type and age of each supernova. Second, the resolution will be adequate to analyze the spectra for line identifications and to test models of line formation. Third, the spectrophotometric accuracy of the scans will provide the data on the photospheric expansion to compare with computations and to derive extragalactic distances.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0012, AERODYNAMICAL PHENOMENA IN STARS

N.H. BAKER, Columbia University, Graduate School, Astronomy, *109 Low Memorial Library, New York, New York* 10027 (AST76-08917 A01)

The research to be carried out under this grant covers a wide variety of topics in theoretical astrophysics. There will be further development of a three dimensional hydrodynamic computer code. This code will be applied to the study of the formation of binary and multiple stellar systems. There will be an investigation of the evolution of carbon stars. This evolution will include the effects of mass loss from the star. There will be an investigation of the various theories on the structure of contact binary stellar systems. The physical processes of the interaction of pulsation and convection in a star will be investigated. Nearby galaxies, as well as our own, possess low intensity radio halos which are presumably gaseous. The source of the gas and its thermal energy is unclear. There will be an investigation of a formation mechanism for these regions.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0013, OBSERVATION AND THEORY IN THE DEVELOPMENT OF ASTRONOMY

B.R. GOLDSTEIN, Univ. of Pittsburgh, School of Arts & Sciences, History & Philosophy of Sci, *4200 5TH Ave., Pittsburgh, Pennsylvania* 15260 (SOC77-23594)

Dr. Goldstein is collecting and analyzing reports of medieval observations of the planets, the moon, and eclipses that survive in Hebrew and Arabic manuscripts for the elucidation of medieval observational techniques and for their potential use by modern astronomers. A search of these manuscripts for additional data on total solar eclipses and other celestial phenomena is also being undertaken.

This research will help to clarify the relationship between theory and observation as well as the way in which instruments were modified on the basis of observational experience in the history of astronomy. Furthermore, the historical records, particularly of eclipses, will help contemporary astronomers in their study of the secular acceleration of the earth and the moon.

SUPPORTED BY U.S. National Science Foundation, Div. of Social Sciences

10.0014, OBSERVATIONS OF BINARY AND PROPER-MOTION STARS

W.D. HEINTZ, Swarthmore College, Graduate School, Astronomy, *Swarthmore, Pennsylvania* 19081 (AST77-12236)

Micrometer observations of visually double and multiple star systems will be carried out with the 24-inch refracting telescope of Swarthmore College. The observing program emphasizes close pairs with significant motions of the components, objects of recent discovery, faint neglected pairs, and some objects which have been observed with an interferometric technique. Approximately ten percent of the observing time of the telescope will be used, with a larger share in summer. Reduction and analysis of these and earlier observations will be carried out. In view of the serious shortage of data on southern hemisphere double stars, application for observing time at Cerro Tololo Interamerican Observatory in Chile is planned to follow up on a recent successful run at that observatory. During part of the summer of 1978, the 40-inch astrometric reflecting telescope at Torino, Italy, will be available part-time to make photographic observations of fainter binary star systems for measurement and analysis at Torino and Swarthmore.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0015, THE NATURE OF YOUNG STARS BELOW THE MAIN SEQUENCE

M. BREGER, Univ. of Texas, School of Natural Sciences, Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST77-22826)

This research program will be concerned with determining the relation between stars presently being born and the material out of which they form. A particular subject to be considered is why a large number of young stars situated near the Orion Nebula appear to be unusually faint. A survey will be carried out which will separate these stars according to the physical processes causing the stars to appear faint. Some possibilities to be investigated include shells and extended envelopes around young stars and the effects of large dust particles between stars. This investigation should strengthen our understanding of early stellar evolution.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0016, RELATIVITY AND RELATED THEORIES

C.M. DEWITT, Univ. of Texas, School of Natural Sciences, Astronomy, *200 W. 21st St., Austin, Texas* 78712 (PHY77-07619)

Topics in gravitation theory and its applications will be initiated. Particular topics to be investigated include:

De Witt-Morette: 1. Nonrelativistic path integrals on curved space: a. Lagrangian formulation; b. Hamiltonian formulation; 2. Relativistic path integrals; a. Classical models; b. Quantum properties.

Matzner: 1. Entropy production near the big bang; 2. Scattering of radiation by black holes.

Shepley: 1. Spinor fields in cosmological models; 2. Mathematical structure of space-time.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

10.0017, PARALLAXES AND PROPER MOTIONS OF STARS

L.W. FREDRICK, Univ. of Virginia, School of Arts & Sciences, Astronomy, *Garrett Hall, Charlottesville, Virginia* 22903 (AST77-20091)

Support is to continue researches aimed at increasing our knowledge of the distances and motions of the stars in the sun's vicinity. Observations of the same star field from the earth on two dates six months apart reveal parallactic shifts in the positions of the nearer stars, since they are viewed from opossite ends of a base line equal to the diameter of the earth's orbit (186,000,000 miles). Only the nearest star is found to have a parallactic shift exceeding one second of arc. Thus, every effort must be made to determine these minute angular shifts with high precision to obtain useful distances for the sun's neighbors. Such distances are the yardstick for all other astronomical distances in the observable universe. Since all stars, including the sun, are in motion through space, the observations also yield these motions and contribute to our understanding of the random and stream motions of the stars in our local portion of the Milky Way Galaxy. When a star's distance is known from this careful triangulation, its true brightness can be determined, a fundamental astrophysical parameter. For double stars whose orbital motions are found, the distance is required for the derivation of the mass of the component stars, another important parameter. Observations at the McCormick Observatory in Virginia and the Mount Stromlo Observatory in Australia will be continued. Emphasis is on astrophysically interesting stars and fundamental problems such as calibration stars and fields, and relating visual radio point sources to the fundamental optical reference coordinate system of stars.

Prior support was by NSF grant AST 75-14345.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0018, FLUID INCLUSIONS IN MINERALS - NASA

E. ROEDDER, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., Herndon, Virginia* 22092 (9710-01151)

Studies of the origin, mode of formation, composition, and significance of fluid inclusion (including both silicate, sulfide, and gas phases) in lunar and meteoritic samples have yielded much data on the magnetic and geologic history of these samples and the processes they have undergone. Some of this information is not otherwise obtainable. Extrapolations to terrestrial sample analogs have been particularly fruitful.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

10.0019, ELECTROCHEMISTRY OF MINERALS - NASA

M. SATO, U.S. Dept. of The Interior, Geological Survey, National Center, *12201 Sunrise Valley Dr., Herndon, Virginia* 22092 (9710-01150)

The project is primarily responsible for determining oxygen fugacity values of lunar rocks, meteorites, tektites, and other planetary matter to provide basic data on the oxidation states of rocks and minerals in the Solar System. On the basis of these data and other available information such as the behavior of volatile matters, we evaluate the causes and mechanisms of oxidation or reduction reactions that occurred during the formation of planetary bodies and magmatic activities.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N79-10001# Army Aviation Research and Development Command, St. Louis, Mo.
AIRCRAFT RAM (MMH/FH) DATA COMPARATIVE ANALYSIS Final Report
Israel Mussbaum May 1978 20 p refs
(AD-A056893; USAAVRADCOM-TR-78-30) Avail: NTIS HC A02/MF A01 CSCL 01/3

This report consists of a comparative analysis of reported Maintenance Manhours per Flight Hour (MMH/FH) for a group of five (5) developmental Army helicopter systems expected to be operational in the mid-1980's time period. The study was initiated as a result of the wide disparity found among the various aircraft programs in how MMH/FH data is obtained as well as how it is processed and displayed. There is a need for uniformity, consistency and validity in the aircraft MMH/FH projections, which form the primary basis for development of aircraft field unit TOEs. Author (GRA)

N79-10002# Advisory Group for Aerospace Research and Development, Paris (France).
ICING TESTING FOR AIRCRAFT ENGINES
Aug. 1978 206 p refs In ENGLISH and FRENCH Presented at the 51st Propulsion and Energetics Panel (A) Spec. Meeting, London, 3-4 Apr. 1978
(AGARD-CP-236; ISBN-92-835-0217-5) Avail: NTIS HC A10/MF A01

Meteorological icing conditions, the microphysical structure of icing clouds and the measurement of snow concentration were discussed. Icing test facilities and their instrumentation current used in the US, UK, and France were reported. Measurement systems, icing of aircraft engines either installed in aircraft and helicopters, or when taken into test facilities were also considered. For individual titles, see N79-10003 through N79-10015.

N79-10003# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
SNOW CONCENTRATION MEASUREMENTS AND CORRELATION WITH VISIBILITY **c47**
J. R. Stallabrass *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 10 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

To allow meaningful design, testing and qualification of aircraft engine intake systems for operation in snow, a program was initiated to measure the snow content of the air. In conjunction with the measurements of snow concentration, various other meteorological parameters were measured. It was found that the snow concentration may be estimated from the visibility with reasonable accuracy, thus permitting concentration statistics to be derived for locations where visibility data exist. Examples of such derived snow concentration probability distributions are presented. J.A.M.

N79-10004# Clermont-Ferrand Univ. (France). Lab. Associe de Meteorologie Physique.
MICROSTRUCTURE OF CLOUD GLACIATION [STRUCTURE MICROPHYSIQUE DES NUAGES GIVRANTS] **c47**
J. F. Gayet and R. G. Soulage *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 12 p refs In FRENCH (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

Results obtained according to the following investigations: (1) June 1975 in the Clermond-Ferrand region; (2) 1976 and (3) January -February 1977 in the Parisian region are reported with reference to cloud drop size and water content. Data were compared with standard icing conditions utilized in the U.S., England, and France. Factors influencing icing were mentioned briefly. Transl. by B.B.

N79-10005# Luftfahrt-Bundesamt, Brunswick (West Germany).
METEOROLOGICAL ICING CONDITIONS **c47**
K. A. Vath *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 22 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

The meteorological influences leading to ice formation on aircraft and engines, their causes and effects, as well as the meteorological icing parameters specified in the airworthiness requirements for public transport airplanes in Europe, the USA, and the USSR are presented. J.A.M.

N79-10006# National Gas Turbine Establishment, Pyestock (England).
ICING TEST FACILITIES AT THE NATIONAL GAS TURBINE ESTABLISHMENT **c09**
R. D. Swift *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 22 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

The extensive capacity of the NGTE Engine Test Facility enabled a close representation of the conditions encountered during flight in icing conditions achieved on a scale such that tests can be made on complete propulsion units (intake, engine and propelling nozzle) or on full scale aircraft components, such as a helicopter fuselage complete with its engines and air intakes. The compressor/exhauster machinery, the test cells, the water spray equipment and the associated instrumentation and calibration gear are described. Illustrations of its use for icing tests on Pegasus and RB211 engines and on the Sea King and Lynx helicopters are given. J.A.M.

N79-10007# Centre d'Essais de Propulseurs, Saclay (France).
INSTALLATION OF ICING TESTS [INSTALLATIONS D'ESSAIS DE GIVRAGE] **c09**
Jacques Bongrand *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 9 p refs In FRENCH (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

Flow velocity and freezing conditions as well as a means for control are described with emphasis placed on measuring procedures for liquid water concentration and droplet size. Various types of tests currently utilized were reviewed. Two test

installations utilized in France for ice testing are briefly described. Transl. by B.B.

N79-10008# ARO, Inc., Arnold Air Force Station, Tenn.
ENGINE ICING MEASUREMENT CAPABILITIES AT THE AEDC **c09**
Jay D. Hunt *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 15 p refs Sponsored in part by AEDC (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

Measurement and control of the principal factors that govern the mechanics and thermodynamics of icing, namely, water droplet size and size distribution, liquid water content, cloud temperature, pressure, and airflow, are discussed. A research program in icing measurements is described, and current results are presented. J.A.M.

N79-10009# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
MEASUREMENT AND CONTROL OF SIMULATED ENVIRONMENTAL ICING CONDITIONS IN AN OUTDOOR, FREE JET, ENGINE GROUND TEST FACILITY **c09**
R. G. Keller *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 13 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

The icing test facility real time control measurement systems are described. Predicted size conditions were compared to measured values obtained from several different measurement systems, including oil slides, rotating cylinders, and laser powered particle counters. J.A.M.

N79-10010# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
THE DYNAMIC ICE DETECTOR FOR HELICOPTERS **c06**
T. R. Ringer and J. R. Stallabrass *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 8 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

The development of an icing detector is described, using a dynamic principle that results in ice being detected equally well whether the helicopter is hovering or at flight cruise speed. The response was rapid allowing the pilots of unprotected helicopters sufficient time to evade further icing within the time limitations. In addition to detecting ice the instrument output can be presented in the form of an icing severity indication or a cloud liquid water content measurement. Integration of the instrument output allowed accurate control of a helicopter electrothermal deicing systems. J.A.M.

N79-10011# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
AIRCRAFT ENGINE ICING, TECHNICAL SUMMARY **c07**
Gordon D. Pfeifer *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 17 p refs (For primary document see N79-10002 01-01)
(Contract DOT-FA76WA-3840)
Avail: NTIS HC A10/MF A01

Aircraft engines ingest supercooled water droplets in concentrations roughly fifty percent greater than cloud concentrations, and the first few stages of the engine compressor are subject to icing. Engine icing can be prevented, or at least kept within tolerable limits, by engine design procedures which utilize: the tendency of the fan to create warmer temperatures by compression effects, the tendency of the rotor to shed ice by centrifugal effects before it get too thick, and various designs of active anti-icing systems. Appropriate background information, equations, and design charts, are summarized, such that a design approach to engine ice prevention can be established. Experimental icing simulation procedures are also presented. J.A.M.

N79-10012# Centre d'Essais de Propulseurs, Saclay (France).
EXPERIMENTAL AND THEORETICAL STUDY OF THE INFLUENCE OF VARIOUS PARAMETERS ON AN ICING SECTION [ETUDE THEORIQUE ET EXPERIMENTALE DE L'INFLUENCE DE DIVERS PARAMETERS SUR LE GIVRAGE D'UN PROFIL] **c02**
Jacques Bongrand *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 13 p refs In FRENCH (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

A theoretical and experimental study to investigate the influence of various parameters on ice formation as an obstacle is presented. The effect of altitude was studied in detail utilizing ground simulation laws. Equally considered were: (1) speed; (2) temperature; and (3) water concentration and water drop size. The accumulation of ice deposit under high altitude conditions was observed and interpreted on two test sections (conical and cylindrical cowlings). Results show that under certain conditions it appears possible to simulate the phenomena by increasing the diameter of the water drops. Transl. by B.B.

N79-10013# National Gas Turbine Establishment, Pyestock (England). Engine Test Dept.
ICING TESTS ON TURBOJET AND TURBOFAN ENGINES USING THE NGTE ENGINE TEST FACILITY **c07**
R. G. J. Ball and A. G. Prince *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 15 p ref (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

Tests were made at conditions representing wet icing, that was with the air supply containing a fine dispersion of supercooled water droplets (volumetric mean diameter nominally 20 microns), but facilities also existed for injecting solid ice particles into the airstream thereby enabling a mixed icing environment to be simulated. Wet icing tests were made on the Olympus 593 powerplant (engine intake combination) and on the RB211 high by pass turbofan. J.A.M.

N79-10014# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Helicopter Div.
TESTS UNDER SNOW AND ICING CONDITIONS WITH THE BO 105 ENGINE INSTALLATION **c07**
Dieter Bender *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 12 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

Corresponding preliminary tests had shown that a snowshield ahead of the main rotor gearbox, in conjunction with the production standard compressor bleed air de-icing, was the most effective form of protection. This snowshield caused the engines to draw their air from a plenum chamber, an arrangement which has resulted in faultless behavior even in extremely heavy snowfall. Proof of operational safety under icing conditions was obtained in a number of steps, beginning with tests in the icing tunnel. Then the helicopter hovered for a total of more than 30 hours, under conditions that were considerably more severe than FAA and CAA requirements. The snowshield and plenum configuration proved itself again in flight trials under natural icing conditions partly under rather severe conditions. In addition, the measurement of atmospheric conditions such as liquid water content, droplet diameter, temperature, and icing severity are briefly discussed. J.A.M.

N79-10015# National Research Council of Canada, Ottawa (Ontario).
ICING TESTS OF A SMALL GAS TURBINE WITH INERTIAL SEPARATION ANTI-ICING SYSTEM **c07**
W. Grabe and D. Tedstone (Pratt and Whitney Aircraft of Can. Ltd., Longueuil Quebec) *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 20 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

Two sea-level icing programs were carried out on Pratt & Whitney Aircraft of Canada PT6 aero engines, protected by inertial separation anti-icing systems. An air ejector, located downstream of the engine, induced air flows in the test section of up to 210 MPH (340 km/h) in icing conditions, to simulate aircraft forward speed. The anti-icing protected the compressor inlet against supercooled water droplets of various diameters, as well as against natural snow. Ice formation in the cowl inlet and bypass sections never rendered the inertial separator inoperative. Inlet total pressure losses increased with ice buildups on inlet surfaces, but generally did not exceed acceptable limits. J.A.M.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N79-10016 Engineering Sciences Data Unit, London (England).
AERODYNAMIC CENTER OF WING-FUSELAGE-NACELLE COMBINATIONS: EFFECT OF REAR-FUSELAGE PYLON MOUNTED NACELLES
Jun. 1978 13 p
(ESDU-78013; ISBN-0-85679-214-4) For information on availability of series, sub-series, and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $434.50

This item calculates the shift at subsonic speeds in aerodynamic centre position, caused by mounting nacelles on short pylons on the rear fuselage of wing-fuselage combinations. The shift is calculated by treating the nacelles as annular aerofoils located in the wing downwash field and subject to nacelle-fuselage interference effects. The shift is then subtracted from the wing-fuselage aerodynamic centre position, to provide the overall aerodynamic centre position of the wing-fuselage-nacelle combination. Rear-mounted nacelles cause a rearward shift in the aerodynamic centre position. ESDU

N79-10017 Texas A&M Univ., College Station.
A LIFTING SURFACE PERFORMANCE ANALYSIS WITH CIRCULATION COUPLED WAKE FOR ADVANCED CONFIGURATION HOVERING ROTORS Ph.D. Thesis
James David Kocurek 1978 221 p
Avail: Univ. Microfilms Order No. 781791

Techniques are developed to combine the lifting surface method with a conventional strip analysis to introduce airfoil section characteristics into the problem. Also, a Gothert type similarity transformation is developed for the hovering rotor. This transformation provides a refined treatment of the important influence of compressibility. These analytical procedures are supported by the development of an improved prescribed wake model derived from schlieren flow visualization studies of model rotor wakes. Numerical experimentation using the lifting surface analysis with the experimentally prescribed wake demonstrates that wake settling rates can be coupled to calculated tip vortex circulation strength such that these parameters are no longer explicitly influenced by rotor blade geometry characteristics. These studies also indicate, however, that wake contraction rate is governed by the overall inflow distribution. Dissert. Abstr.

N79-10018 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
A NUMERICAL SOLUTION OF SUPERSONIC AND HYPERSONIC VISCOUS FLOW FIELDS AROUND THIN PLANAR DELTA WINGS Ph.D. Thesis
Guion Stewart Bluford, Jr. 1978 235 p
Avail: Univ. Microfilms Order No. 7819267

A numerical technique was used to compute the supersonic and hypersonic, viscous flow fields around thin planar delta wings. These solutions were obtained by solving the Navier-Stokes equations subject to a conical approximation. The integration technique used was the second-order accurate, finite difference scheme. This numerical integration was performed on a constant step size array generated by a conical coordinate transformation. Solutions were obtained for the upper-only, lower-only, and total flow fields around delta wings with supersonic leading edges. Numerical oscillations, due to shock capturing, were reduced by applying normal stress damping and a fourth-order density damping term to the finite difference equations. A stability criteria was developed and used which accounted for both the viscous and inviscid flow regions. The shock-induced vortex within the viscous region and the hypersonic viscous bubble on top of the boundary layer were computed. Dissert. Abstr.

N79-10019 California Inst. of Tech., Pasadena.
FLYING HOT-WIRE STUDY OF TWO-DIMENSIONAL TURBULENT SEPARATION ON AN NACA 4412 AIRFOIL AT MAXIMUM LIFT Ph.D. Thesis
Alan James Wadcock 1978 148 p
Avail: Univ. Microfilms Order No. 7818203

Hot-wire measurements were made in the boundary layer, the separated region, and the near wake for flow past an NACA 4412 airfoil at maximum lift. The Reynolds number based on chord was about 1,500,000. Special care was taken to achieve a two-dimensional mean flow. The main instrumentation was a hot-wire probe mounted on the end of a rotation arm. A digital computer was used to control synchronized sampling and storage of hot-wire data at closely spaced points along the probe arc. Data, obtained at several thousand locations in the flow field, include intermittency, two components of mean velocity, and mean values for three double, four triple, and five quadruple products of two velocity fluctuations. No information was obtained about the spanwise velocity component. The data are available on punched cards in raw form and also in processed form. Dissert. Abstr.

N79-10020*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
UTILIZATION OF THE WING-BODY AERODYNAMIC ANALYSIS PROGRAM
Robert E. Curry Oct. 1978 29 p refs
(NASA-TM-72856 ; H-1071) Avail: NTIS HC A03/MF A01 CSCL 01A

The analysis program was used to investigate several aircraft characteristics. The studies performed included vehicle stability analysis, determination of upwash angle, identification of nonpotential flow, launch dynamics, and wake vortex upset loads. The techniques and are discussed. When possible, computed results are compared with experimental data. G.G.

N79-10021*# Wichita State Univ., Kans.
WIND TUNNEL TESTS OF THE GA(W)-2 AIRFOIL WITH 20% AILERON, 25% SLOTTED FLAP, 30% FOWLER FLAP AND 10% SLOT-LIP SPOILER
W. H. Wentz, Jr. Jan. 1977 75 p refs
(Grant NsG-1165)
(NASA-CR-145139; AR-76-2) Avail: NTIS HC A04/MF A01 CSCL 01A

Two dimensional wind tunnel tests were conducted for the GA(W)-2 airfoil section with: 20% aileron, 25% slotted flap; 30% Fowler flap, and 10% slot-lip spoiler. All tests were conducted at a Reynolds number of 2,200,000 and a Mach Number of 0.13. In addition to force measurements, tuft studies were conducted for the slotted and Fowler flap configurations. Aileron and spoiler hinge moments were obtained by integration of surface pressure measurements. Tests results show that a value of 3.82 was obtained with 30% Fowler flap. Aileron control effectiveness and hinge moments were similar to other airfoils. The slot-lip spoiler provided powerful, positive roll control at all flap settings. J.A.M.

N79-10022*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC PERFORMANCE OF A 1.35-PRESSURE-RATIO AXIAL-FLOW FAN STAGE
Walter M. Osborn, Royce D. Moore, and Ronald J. Steinke Oct. 1978 108 p refs
(NASA-TP-1299; E-9025) Avail: NTIS HC A06/MF A01 CSCL 01A

The overall blade element performances and the aerodynamic design parameters are presented for a 1.35-pressure-ratio fan stage. The fan stage was designed for a weight flow of 32.7 kilograms per second and a tip speed of 302.8 meters per second. At design speed the stage peak efficiency of 0.879 occurred at a pressure ratio of 1.329 and design flow. Stage stall margin was approximately 14 percent. At design flow rotor efficiency was 0.94 and the pressure ratio was 1.360. B.B.

N79-10023*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COMPUTER PROGRAM FOR THE CALCULATION OF THE FLOW FIELD IN SUPERSONIC MIXED-COMPRESSION INLETS AT ANGLE OF ATTACK USING THE THREE-DIMENSIONAL METHOD OF CHARACTERISTICS WITH DISCRETE SHOCK WAVE FITTING
Joseph Vadyak (Purdue Univ., West Lafayette, Ind.), Joe D.

Hoffman (Purdue Univ., West Lafayette, Ind.), and Allan R. Bishop Jun. 1978 173 p refs
(Grant NGR-15-005-191)
(NASA-TM-78947; E-9694) Avail: NTIS HC A08/MF A01 CSCL 01A

The calculation procedure is based on the method of characteristics for steady three-dimensional flow. The bow shock wave and the internal shock wave system were computed using a discrete shock wave fitting procedure. The general structure of the computer program is discussed, and a brief description of each subroutine is given. All program input parameters are defined, and a brief discussion on interpretation of the output is provided. A number of sample cases, complete with data deck listings, are presented. G.G.

N79-10024*# Northrop Corp., Hawthorne, Calif. Aircraft Group.
STUDY OF AERODYNAMIC TECHNOLOGY FOR VSTOL FIGHTER/ATTACK AIRCRAFT: HORIZONTAL ATTITUDE CONCEPT Final Report
S. H. Brown May 1978 242 p refs Sponsored in part by the David Taylor Naval Ship Research and Development Center, Bethesda, Md.
(Contract NAS2-9771)
(NASA-CR-152130; NOR78-54) Avail: NTIS HC A11/MF A01 CSCL 01A

A horizontal attitude VSTOL (HAVSTOL) supersonic fighter attack aircraft powered by RALS turbofan propulsion system is analyzed. Reaction control for subaerodynamic flight is obtained in pitch and yaw from the RALS and roll from wingtip jets powered by bleed air from the RALS duct. Emphasis is placed on the development of aerodynamic characteristics and the identification of aerodynamic uncertainties. A wind tunnel program is shown to resolve some of the uncertainties. Aerodynamic data developed are static characteristics about all axes, control effectiveness, drag, propulsion induced effects and reaction control characteristics. G.Y.

N79-10025*# General Dynamics/Fort Worth, Tex.
STUDY OF AERODYNAMIC TECHNOLOGY FOR VSTOL FIGHTER/ATTACK AIRCRAFT, VOLUME 1 Final Report, 1 Nov. 1977 - 31 May 1978
J. R. Lummus May 1978 264 p refs Sponsored in part by the David Taylor Naval Ship Research and Development Center, Bethesda, Md.
(Contract NAS2-9769)
(NASA-CR-152128) Avail: NTIS HC A12/MF A01 CSCL 01A

An assessment was made of the aerodynamic uncertainties associated with the design of a cold-deck-environment Navy VSTOL fighter/attack aircraft utilizing jet-diffuser ejectors for vertical lift and vectored-engine-over-wing blowing for supercirculation benefits. The critical aerodynamic uncertainties were determined as those associated with the constraints which size the aircraft to a specified set of requirements. A wind tunnel model and test programs are recommended for resolving these uncertainties. G.G.

N79-10026*# Northrop Corp., Hawthorne, Calif.
STUDY OF AERODYNAMIC TECHNOLOGY FOR VSTOL FIGHTER/ATTACK AIRCRAFT: VERTICAL ATTITUDE CONCEPT Final Report, 1 Nov. 1977 - 31 May 1978
H. A. Gerhardt and W. S. Chen May 1978 253 p refs Sponsored in part by the David Taylor Naval Ship Research and Development Center, Bethesda, Md.
(Contract NAS2-9771)
(NASA-CR-152131) Avail: NTIS HC A12/MF A01 CSCL 01A

The aerodynamic technology for a vertical attitude VSTOL (VATOL) supersonic fighter/attack aircraft was studied. The selected configuration features a tailless clipped delta wing with leading-edge extension (LEX), maneuvering flaps, top-side inlet, twin dry engines and vectoring nozzles. A relaxed static stability is employed in conjunction with the maneuvering flaps to optimize transonic performance and minimize supersonic trim drag. Control for subaerodynamic flight is obtained by gimballing the nozzles in combination with wing tip jets. Emphasis is placed on the development of aerodynamic characteristics and the identification of aerodynamic uncertainties. A wind tunnel test program is proposed to resolve these uncertainties and ascertain the feasibility of the conceptual design. Ship interface, flight control integration, crew station concepts, advanced weapons, avionics, and materials are discussed. G.Y.

N79-10027*# Grumman Aerospace Corp., Bethpage, N.Y.
STUDY OF AERODYNAMIC TECHNOLOGY FOR VSTOL FIGHTER ATTACK AIRCRAFT Final Report, 1 Nov. 1977 - 23 May, 1978
W. Burhans, Jr., Vincent J. Crafta, Jr., N. Dannenhoffer, Frank A. Dellamura, and Robert E. Krepski 23 May 1978 196 p refs Sponsored in part by David Taylor Naval Ship Research and Development Center, Bethesda, Md.
(Contract NAS2-9770)
(NASA-CR-152129; PDR-623-24) Avail: NTIS HC A09/MF A01 CSCL 01A

Vertical short takeoff aircraft capability, supersonic dash capability, and transonic agility were investigated for the development of Fighter/attack aircraft to be accommodated on ships smaller than present aircraft carriers. Topics covered include: (1) description of viable V/STOL fighter/attack configuration (a high wing, close-coupled canard, twin-engine, control configured aircraft) which meets or exceeds specified levels of vehicle performance; (2) estimates of vehicle aerodynamic characteristics and the methodology utilized to generate them; (3) description of propulsion system characteristics and vehicle mass properties; (4) identification of areas of aerodynamic uncertainty; and (5) a test program to investigate the areas of aerodynamic uncertainty in the conventional flight mode. A.R.H.

N79-10028*# Vought Corp., Dallas, Tex.
STUDY OF AERODYNAMIC TECHNOLOGY FOR VSTOL FIGHTER/ATTACK AIRCRAFT, PHASE 1 Final Report, Nov. 1977 - May 1978
Herbert H. Driggers May 1978 182 p refs Sponsored in part by David Taylor Naval Ship Research and Development Center, Bethesda, Md.
(Contract NAS2-9772)
(NASA-CR-152132; Rept-2-31200/8CR-79) Avail: NTIS HC A09/MF A01 CSCL 01A

A conceptual design study was performed of a vertical attitude takeoff and landing (VATOL) fighter/attack aircraft. The configuration has a close-coupled canard-delta wing, side two-dimensional ramp inlets, and two augmented turbofan engines with thrust vectoring capability. Performance and sensitivities to objective requirements were calculated. Aerodynamic characteristics were estimated based on contractor and NASA wind tunnel data. Computer simulations of VATOL transitions were performed. Successful transitions can be made, even with series post-stall instabilities, if reaction controls are properly phased. Principal aerodynamic uncertainties identified were post-stall aerodynamics, transonic aerodynamics with thrust vectoring and inlet performance in VATOL transition. A wind tunnel research program was recommended to resolve the aerodynamic uncertainties. Author

N79-10029# Army Research and Technology Labs., Moffett Field, Calif.
VELOCITY MEASUREMENT ABOUT A NACA 0012 AIRFOIL WITH A LASER VELOCIMETER
Danny R. Hoad, Warren H. Young, Jr., and James F. Meyers Jun. 1978 15 p refs
(AD-A056447) Avail: NTIS HC A02/MF A01 CSCL 20/4

A laser velocimeter measured the velocity field about a wing with a NACA 0012 airfoil section. These measurements were compared at two low angles of attack (0 deg, 4.15 deg) with a two-dimensional viscous-flow prediction program. At 0 deg, the comparison provided confidence in the effectiveness and accuracy of the laser velocimeter. At 4.15 deg, the data indicated that a small laminar separation bubble with oscillating shear layer probably existed. The unique capability of the laser velocimeter in measuring absolute flow magnitude and direction without prior knowledge of general flow direction was demonstrated in the complex separated reverse flows over the wing at an angle of attack of 19.4 deg. GRA

N79-10030# Nielsen Engineering and Research, Inc., Mountain View, Calif.

IMPROVED TRANSONIC NOSE DRAG ESTIMATES FOR THE NSWC MISSILE AERODYNAMIC COMPUTER PROGRAM Technical Report, 4 Mar. - 4 Oct. 1977

Denny S. Chaussee Apr. 1978 71 p refs
(Contract N60921-77-C-A085)
(AD-A056795; NEAR-TR-153; NSWC/DL-TR-3830) Avail: NTIS HC A04/MF A01 CSCL 20/4

An axisymmetric implicit unsteady Euler equation solver has been applied to the transonic flow past sphere-ogive-cylinder bodies. This paper documents this method and shows results that were obtained for the full range of transonic Mach numbers, 0.7 < or = M free stream < or = 1.2. A rather extensive parametric study of sphere-ogive-cylinders was performed over the transonic Mach number range. Nose pressure drag values were calculated and are presented for varying nose radii, 0. to 1.0, varying nose length, 1.0 to 10.0 and varying Mach numbers, 0.7 to 1.2, where all geometric quantities are normalized with respect to the maximum body radius. These results have been included in the NSWC Missile Aerodynamic Computer program to improve transonic nose drag estimates. Author (GRA)

N79-10031# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.

AEROBALLISTICS OF CORKSCREW PROJECTILES

Anders S. Platou Jun. 1978 12 p refs
(AD-A056475) Avail: NTIS HC A02/MF A01 CSCL 19/4

During the development and exploitation of the BRL Non-Conical Boattail Projectile, it became evident that a new projectile shape which combines a triangular nose with a triangular boattail would have low drag and a long wheel base for low balloting in the gun barrel. No aerodynamic data were available on the configuration (nicknamed the corkscrew) at the beginning of this program, so it was deemed advisable to conduct wind tunnel and range tests to determine its drag and stability characteristics. GRA

N79-10032# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab.

METHOD TO EXPERIMENTALLY DETERMINE THE AERODYNAMIC PRESSURE DISTRIBUTION ON SPINNING BODIES

Miles C. Miller Jun. 1978 15 p refs
(AD-A056468) Avail: NTIS HC A02/MF A01 CSCL 20/4

Many Army weapon systems involve spinning aerodynamic bodies such as artillery shells, guided missiles, and Magnus rotor submunitions. The source of numerous flight instability problems has been related to the effect of body spin on the aerodynamic surface pressures. Although wind tunnel testing is the major means for determining the aerodynamic characteristics of these configurations, measurement of the surface pressures has been limited to non-spinning models. This paper describes a new and unique method to experimentally measure the aerodynamic pressure distribution on the surface of spinning wind tunnel models incorporating a special instrumentation scheme. A pressure tap located in the non-spinning inner portion of the wind tunnel model detects the surface pressure through a series of vent holes in the spinning outer portion of the model, the pressure being retained for measurement by means of a sliding seal arrangement. The feasibility of the method was thoroughly demonstrated by means of wind tunnel tests of fundamental model configurations. The test program was conducted in two phases. The test method measured the surface pressure distribution acting on a spinning smooth surfaced cylinder in crossflow in the critical Reynolds number regime. This proved the method's capability to measure a steady state flow condition under various spin rate and free stream velocity conditions. GRA

N79-10033# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.

USER'S MANUAL FOR THE MARTIN-MARIETTA HIGH ANGLE OF ATTACK AERODYNAMIC METHODOLOGY FOR BODY TAIL MISSILES

Gary C. Winn Jun. 1978 85 p refs
(AD-A057138; DRDMI-T-78-63) Avail: NTIS HC A05/MF A01 CSCL 20/4

This report documents the computer program developed by the Army to evaluate and implement an aerodynamic methodology developed by the Martin Marietta Corporation. The methodology was developed to predict aerodynamic forces on slender missile bodies with low aspect ratio tails at low and high angles of attack, at arbitrary roll angles for both transonic and supersonic velocities. Author (GRA)

N79-10034# Purdue Univ., Lafayette, Ind.

AXIAL FLOW IN TRAILING LINE VORTICES

Mahinder S. Uberoi, Bhimsen K. Shivamoggi, and Sin-Sung Chen Jun. 1978 17 p refs Sponsored by Colorado Univ., Boulder
(Contract N00014-75-C-1143; Proj. SQUID)
(AD-A057075; SQUID-UC-2-PU) Avail: NTIS HC A02/MF A01 CSCL 20/4

Axial flow in the core of laminar steady trailing vortex from the tip of a semi-infinite lifting wing is analyzed, assuming that the pressure gradient is determined by the swirl velocities of an ideal infinite line vortex. The axial and lateral variations of the axial velocity depend on the strength of the vortex and initial axial velocity distribution which must be specified at some station behind the wing. Author (GRA)

N79-10035# Sandia Labs., Albuquerque, N. Mex.

EQUATIONS OF MOTION FOR FREE-FLIGHT SYSTEMS OR ROTATING-TRANSLATING BODIES HAVING VARIABLE MASS AND CONFIGURATION

A. E. Hodapp, Jr. Mar. 1978 40 p refs
(Contract EY-76-C-04-0789)
(SAND-77-0606) Avail: NTIS HC A03/MF A01

General vector differential equations of motion were developed for a system of rotating translating, unbalanced, variable mass, variable configuration bodies. Complete flexibility was provided in placement of the reference coordinates within the system of bodies and in placement of body fixed axes within body. Examples are presented to demonstrate the ease with which these equations can be reduced to the questions of motion for systems of interest. DOE

N79-10036# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.

NUMERICAL CALCULATION OF TRANSONIC FLOW PAST A SWEPT WING BY A FINITE VOLUME METHOD

A. Jameson 1977 25 p refs
(Contract EY-76-C-02-3077)
(CONF-771204-3) Avail: NTIS HC A02/MF A01

The finite volume method for the numerical calculation of transonic flow past a swept wing was developed and its use for calculating the pressure distribution on the upper surface of a Onera m6 wing in Mach No. 0.84 flow and of a Douglas DC10 wing in M = 0.85 flow was illustrated. Calculated results were compared with experimental data. It appears that it can be used to treat configurations of more or less arbitrary complexity, subject to limits set by the power of the available computers. The extension to configurations is primarily a matter of devising mesh generating schemes, since the internal computations are essentially independent of the configuration, apart from the identification of which elements are the boundary elements. Author (DOE)

N79-10012# Centre d'Essais de Propulseurs, Saclay (France).

EXPERIMENTAL AND THEORETICAL STUDY OF THE INFLUENCE OF VARIOUS PARAMETERS ON AN ICING SECTION [ETUDE THEORIQUE ET EXPERIMENTALE DE L'INFLUENCE DE DIVERS PARAMETERS SUR LE GIVRAGE D'UN PROFIL]

Jacques Bongrand *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 13 p refs In FRENCH (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N79-10037# BioTechnology, Inc., Falls Church, Va.
AN EVALUATION OF A NEW FORMAT FOR EJECTION INFORMATION IN A NATOPS MANUAL Final Report
Theodore J. Post and Robert L. Kershner 15 May 1978 59 p refs
(Contract N00014-77-C-0321; NR Proj. 207-068)
(AD-A056910) Avail: NTIS HC A04/MF A01 CSCL 01/3

Naval Aviation Training and Operating Procedures Standardization (NATOPS) Manuals include procedures for operating equipment under normal and emergency conditions. Invariably, emergency conditions require an immediate and accurate response, demanding that the performer knows precisely what to do and when and how to do it. Since the performer is not free to refer to the NATOPS under these conditions, NATOPS coverage of emergency procedures should, but frequently does not, employ formats which emphasize clarity, learning and recall. This project used the ejection procedures section of the T-2 aircraft NATOPS manual to study this topic. Specific objectives were to: Reformat the ejection section of the T-2 NATOPS manual to conform to state-of-the-art information presentation techniques; Compare the difference in performance between subjects using the current NATOPS manual and those using the reformatted materials; and Recommend to the Naval Air Systems Command a course of action based on the results of the evaluation. The results of the evaluation revealed that the groups using the reformatted NATOPS materials outscored the groups using the current NATOPS materials in all the content areas. Moreover, in envelope assessment, the students who studied the new materials convincingly outscored the students given the old presentation. This research indicates that the documentation used in this evaluation is an effective means of fostering the learning of ejection information. Author (GRA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N79-10038*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
Paul F. Flanagan Sep. 1978 49 p refs
(Contract NAS2-9460)
(NASA-CR-152187) Avail: NTIS HC A03/MF A01 CSCL 17G

The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmentor wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing mimimum fuel trajectories for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorithms implemented in the avionics software. J.M.S.

N79-10039*# National Aeronautics and Space Administration. Pasadena Office, Calif.
INTERFEROMETRIC LOCATING SYSTEM Patent Application
Peter F. MacDoran, inventor (to NASA) (JPL) Filed 31 Aug. 1978 23 p
(Contract NAS7-100)
(NASA-Case-NPO-14173-1; US-Patent-Appl-SN-938581) Avail: NTIS HC A02/MF A01 CSCL 17G

An object of the invention is to provide a system for locating aircraft or other targets by a group of land-based radio receivers. One system detects broadband noise emitted from the target, to detect even hostile aircraft. Another system utilizes narrow band bursts emitted from low cost transmitters in aircraft, to detect a large number of aircraft in an area while requiring a limited frequency band. NASA

N79-10040# Arinc Research Corp., Annapolis, Md.
AVIONICS COST DEVELOPMENT FOR CIVIL APPLICATION OF GLOBAL POSITIONING SYSTEM Interim Report
S. H. Kowalski Jul. 1978 32 p refs
(Contract DOT-FA76WA-3788)
(AD-A056936; REPT-1326-01-4-1771) Avail: NTIS HC A03/MF A01 CSCL 17/7

This study of costs for avionics for civil use of the Global Positioning System (GPS), performed for the FAA Office of Systems Engineering Management (OSEM), was based on a uniform approach to cost estimating with the assistance of a pricing model. The system evaluated is the military-developed Z set with appropriate packaging modifications to meet the requirements of air carrier avionics standards and the less stringent environmental and packaging requirements for general aviation. Author (GRA)

N79-10041# National Technical Information Service, Springfield, Va.
MICROWAVE LANDING SYSTEMS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1978
William E. Reed Jul. 1978 153 p Supersedes NTIS/PS-77/0617; NTIS/PS-76/0555; NTIS/PS-75/417
(NTIS/PS-78/0731/6; NTIS/PS-77/0617; NTIS/PS-76/0555; NTIS/PS-75/417) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

Federally-sponsored research on the planning, development, and operation of aircraft microwave landing systems is presented. Studies include feasibility, systems engineering, equipment, signal propagation, and cost analysis. This updated bibliography contains 122 abstracts, 25 of which are new entries to the previous edition. GRA

N79-10042# National Technical Information Service, Springfield, Va.
MICROWAVE LANDING SYSTEMS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1978
William E. Reed Jul. 1978 94 p Supersedes NTIS/PS-77/0618; NTIS/PS-76/0556
(NTIS/PS-78/0732/4; NTIS/PS-77/0618; NTIS/PS-76/0556) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

The bibliography cites reports from worldwide research on the planning, development, and operation of microwave landing systems, including feasibility systems engineering, equipment, signal propagation, and cost analysis. This updated bibliography contains 80 abstracts, 11 of which are new entries to the previous edition. GRA

N79-10043# National Technical Information Service, Springfield, Va.
AIR TRAFFIC CONTROL SIMULATION MODELS, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - 1975
Guy E. Habercom, Jr. Aug. 1978 224 p
(NTIS/PS-78/0787/8) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

En-route and terminal air traffic control facilities are investigated by use of mathematical models and computerized simulators. Ground based and satellite navigational aids are modeled for present and predicted air traffic requirements.

Worldwide networks for traffic scheduling are simulated. This updated bibliography contains 217 abstracts, none of which are new entries to the previous edition. GRA

N79-10044# National Technical Information Service, Springfield, Va.
AIR TRAFFIC CONTROL SIMULATION MODELS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS
Progress Report, 1976 - Jun. 1978
Guy E. Habercom, Jr. Aug. 1978 132 p Supersedes NTIS/PS-77/0702; NTIS/PS-76/0610; NTIS/PS-75/521 (NTIS/PS-78/0788/6; NTIS/PS-77/0702; NTIS/PS-76-0610; NTIS/PS-75/521) Avail: NTIS HC $28.00/MF $28.00 CSCL 17G

En-route and terminal air traffic control facilities are investigated by use of mathematical models and computerized simulations. Ground based and satellite navigational aids are modeled for present and predicted air traffic requirements. Worldwide networks for traffic scheduling are simulated. (This updated bibliography contains 125 abstracts, 41 of which are new entries to the previous edition). GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N79-10045*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIRECT NUMERICAL SOLUTION OF THE TRANSONIC PERTURBATION INTEGRAL EQUATION FOR LIFTING AND NONLIFTING AIRFOILS
David Nixon Sep. 1978 27 p refs
(NASA-TM-78518; A-7591) Avail: NTIS HC A03/MF A01 CSCL 01A

The linear transonic perturbation integral equation previously derived for nonlifting airfoils is formulated for lifting cases. In order to treat shock wave motions, a strained coordinate system is used in which the shock location is invariant. The tangency boundary conditions are either formulated using the thin airfoil approximation or by using the analytic continuation concept. A direct numerical solution to this equation is derived in contrast to the iterative scheme initially used, and results of both lifting and nonlifting examples indicate that the method is satisfactory. Author

N79-10046*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT RESEARCH CAPABILITIES OF THE NASA/ARMY ROTOR SYSTEMS RESEARCH AIRCRAFT
Samuel White, Jr. and Gregory W. Condon Sep. 1978 30 p refs
(NASA-TM-78522; A-7602) Avail: NTIS HC A03/MF A01 CSCL 01C

A description is given of the capabilities and limitations of the Rotor Systems Research Aircraft (RSRA) that was demonstrated during the development contract, and assesses the expected research capabilities of the RSRA on delivery to the government. L.S.

N79-10047*# Northrop Corp., Hawthorne, Calif. Aircraft Group.
NORTHROP F-5F SHARK NOSE DEVELOPMENT
O. R. Edwards Oct. 1978 235 p refs
(Contract NAS1-15159)
(NASA-CR-158936) Avail: NTIS HC A11/MF A01 CSCL 01C

During spin susceptibility testing of the Northrop F-5F airplane, two erect spin entries were obtained from purely longitudinal control inputs at low speed. Post flight analysis of the data showed that the initial yaw departure occurred at zero sideslip, and review of wind tunnel data showed significant yawing moments present at angles of attack well above stall. Further analysis of this wind tunnel data indicated that the yawing moments were being generated by the long slender nose of the airplane. Redesign of the nose was accomplished, resulting in a nose configuration which completely alleviated the asymmetric yawing moments. J.A.M.

N79-10048*# Boeing Co., Wichita, Kans.
LOAD AND DYNAMIC ASSESSMENT OF B-52B-008 CARRIER AIRCRAFT FOR FINNED CONFIGURATION 1 SPACE SHUTTLE SOLID ROCKET BOOSTER DECELERATOR SUBSYSTEM DROP TEST VEHICLE. VOLUME 1: SUMMARY
Delmar A. Quade 9 Jun. 1978 68 p refs 4 Vol.
(Contract NAS8-31805)
(NASA-CR-150833; D3-11220-2-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 01C

The B-52B airplane was identified for use in solid rocket booster (RSB) parachute drop flight testing. The purpose of this study was to determine by theoretical analysis methods the compatability and structural capability of B-52B drop test vehicle configuration (with fins) to accomplish the drop test mission. This document consist of four volumes. This volume presents a summary of airplane flutter and load strength evaluation analysis results and a comparative study of the pylon loading resulting from drop test vehicle inertia and aerodynamic considerations. G.Y.

N79-10049*# Boeing Co., Wichita, Kans.
LOAD AND DYNAMIC ASSESSMENT OF B-52B-008 CARRIER AIRCRAFT FOR FINNED CONFIGURATION 1 SPACE SHUTTLE SOLID ROCKET BOOSTER DECELERATOR SUBSYSTEM DROP TEST VEHICLE. VOLUME 2: AIRPLANE FLUTTER AND LOAD ANALYSIS RESULTS
Delmar A. Quade 9 Jun. 1978 72 p refs 4 Vol.
(Contract NAS8-31805)
(NASA-CR-150834; D3-11220-2-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 01C

The airplane flutter and maneuver-gust load analysis results obtained during B-52B drop test vehicle configuration (with fins) evaluation are presented. These data are presented as supplementary data to that given in Volume 1 of this document. A brief mathematical description of airspeed notation and gust load factor criteria are provided as a help to the user. References are defined which provide mathematical description of the airplane flutter and load analysis techniques. Air-speed-load factor diagrams are provided for the airplane weight configurations reanalyzed for finned drop test vehicle configuration. G.Y.

N79-10050*# Boeing Co., Wichita, Kans.
LOAD AND DYNAMIC ASSESSMENT OF B-52B-008 CARRIER AIRCRAFT FOR FINNED CONFIGURATION 1 SPACE SHUTTLE SOLID ROCKET BOOSTER DECELERATOR SUBSYSTEM DROP TEST VEHICLE. VOLUME 3: PYLON LOAD DATA METHOD 1
Delmar A. Quade 9 Jun. 1978 135 p refs 4 Vol.
(Contract NAS8-31805)
(NASA-CR-150835; D3-11220-2-Vol-3) Avail: NTIS HC A07/MF A01 CSCL 01C

The pylon loading at the drop test vehicle and wing interface attach points is presented. The loads shown are determined using a stiffness method, which assumes the side stiffness of the foreward hook guide to be one-fourth of the fore and aft stiffness of each drag pin. The net effect of this assumption is that the forward hook guide reacts approximately 85% of the drop test vehicle yawing moment. For a comparison of these loads to previous X-15 analysis design loadings, see Volume 1 of this document. G.Y.

N79-10051*# Boeing Co., Wichita, Kans.
LOAD AND DYNAMIC ASSESSMENT OF B-52B-008 CARRIER AIRCRAFT FOR FINNED CONFIGURATION 1 SPACE SHUTTLE SOLID ROCKET BOOSTER DECELERATION SUBSYSTEM DROP TEST VEHICLE. VOLUME 4: PYLON LOAD DATA
Delmar A. Quade 9 Jun. 1978 135 p refs 4 Vol.
(Contract NAS8-31805)
(NASA-CR-150836; D3-11220-2-Vol-4) Avail: NTIS HC A07/MF A01 CSCL 01C

The pylon loading at the drop test vehicle and wing interface attack points is presented. The loads shown are determined using a stiffness method, which assumes the side stiffness of the forward hook guide and the fore and aft stiffness of each drag pin to be equal. The net effect of this assumption is that the forward hook guide reacts approximately 96% of the drop test vehicle yawing moment. For a comparison of these loads to previous X-15 analysis design loadings, see Volume 1 of this document.
G.Y.

N79-10052# Ballistic Research Labs., Aberdeen Proving Ground, Md.
HIGHLY SURVIVABLE TRUSS TYPE TAIL BOOM
Thomas F. Erline Jun. 1978 15 p refs
(AD-A056430) Avail: NTIS HC A02/MF A01 CSCL 01/3

Successful completion of Army helicopter missions in future battle scenarios may well depend upon survival of the structure after battle damage. Survivability of a helicopter will depend significantly upon the structure's ability to retain structural integrity. The principle purpose of this study is to develop a structural concept which assures a high degree of confidence in the integrity of a structure that has received combat damage. This study has been pursued because the Army needs to meet and provide a solution to the ever escalating high explosive anti-aircraft threat to the helicopter tail boom.
GRA

N79-10053# Army Aviation Research and Development Command, St. Louis, Mo.
DOPPLER HOVER SYSTEM (DHS) FLIGHT TEST REPORT
Christos M. Tsoubanos Apr. 1978 44 p refs
(AD-A056777; USAAVRADCOM-TR-78-10) Avail: NTIS HC A03/MF A01 CSCL 01/2

This report presents the flight test evaluation of a self-contained hover system concept design for the AAH and ASH helicopters. The configured system includes the Lightweight Doppler Navigation System (LDNS), a simulated Pilot Night Vision System (PNVS) utilizing a closed circuit daylight TV system and analog symbol generator. The emphasis of the flight test was to determine hover performance and the potential of the LDNS to provide adequate velocity information near zero. This velocity and other quantitative parameters were symbolically displayed with imagery on a panel-mounted CRT such that the pilot was able to manipulate them to maintain an accurate manual hover.
GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N79-10054*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT EXPERIENCE WITH ADVANCED CONTROLS AND DISPLAYS DURING PILOTED CURVED DECELERATING APPROACHES IN A POWERED-LIFT STOL AIRCRAFT
W. S. Hindson (Natl. Aeron. Estab., Ottawa) and G. H. Hardy Sep. 1978 14 p refs
(NASA-TM-78527; A-7625) Avail: NTIS HC A02/MF A01 CSCL 01D

The control, display, and procedural features are described for a flight experiment conducted to assess the feasibility of piloted STOL approaches along predefined, steep, curved, and decelerating approach profiles. It was found to be particularly important to assist the pilot through use of the flight director computing capability with the lower frequency control-related tasks, such as those associated with monitoring and adjusting configuration trim as influenced by atmospheric effects, and preventing the system from exceeding powerplant and SAS authority limitations. Many of the technical and pilot related issues identified in the course of this flight investigation are representative of similarly demanding operational tasks that are thought to be possible only through the use of sophisticated control and display systems.
A.R.H.

N79-10055# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SPARE MEMORY AND TIMING PARAMETERS IN AVIONICS COMPUTER SYSTEM REQUIREMENTS M.S. Thesis
Gary B. Wigle Dec. 1977 90 p refs
(AD-A056521; AFIT-GSM/SM/77D-30) Avail: NTIS HC A05/MF A01 CSCL 01/3

Avionics computers require continuous software maintenance support during the life cycle of the airborne system. Spare memory and timing capability should be provided with the initial acquisition of the system. Too often, additional capability must be acquired at a later date and at a high cost. Current recommendations for spare capacity vary between 20 and 100 percent. An analysis has been made on 25 computers in 14 Air Force airborne systems to determine the growth of software and hardware size to date. The results of this analysis indicate that 100-300 percent spare memory should be provided in avionics computers that process data for navigation, weapons control, radar, electronic warfare, or any other function that has changing mission requirements. Also, only 25 percent spare memory is needed in avionics computers associated with missiles, status monitoring, fault isolation, or similar functions. Not enough data is available to reach any sound conclusions concerning the timing in avionics computers.
Author (GRA)

N79-10056# Army Avionics Research and Development Activity, Fort Monmouth, N. J.
INTEGRATED AVIONICS CONTROL SYSTEM (IACS)
Charles A. Pleckaitis, Carl J. Balanti, Anthony S. Santanelli, and George Stech Jun. 1978 14 p
(AD-A056476) Avail: NTIS HC A02/MF A01 CSCL 01/3

The concept of an Integrated Avionics Control Systems (IACS) in military aircraft has evolved from a significant increase in the number of electronic systems available for use on Army aircraft today. A system such as IACS is needed for Army aviation because it reduces the crew workload, reduces demands on already crowded cockpits and makes new installation less difficult and less expensive. Recently, considerable emphasis has been placed on reducing the cost of new avionics systems, thus the IACS program is being pursued under the design-to-cost concept. This paper discusses the Army approach to an integrated avionics control system. The background of the program is outlined, followed by a description of the overall IACS and its operation.
GRA

N79-10010# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
THE DYNAMIC ICE DETECTOR FOR HELICOPTERS
T. R. Ringer and J. R. Stallabrass *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 8 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N79-10057* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPARATUS AND METHOD FOR REDUCING THERMAL STRESS IN A TURBINE ROTOR Patent
Jack A. Heller, inventor (to NASA) Issued 3 Oct. 1978 6 p Filed 4 Mar. 1977 Supersedes N77-18160 (15 - 09, p 1135)
(NASA-Case-LEW-12232-1; US-Patent-4,117,669; US-Patent-Appl-SN-776029; US-Patent-Class-60-39.14; US-Patent-Class-415-115; US-Patent-Class-415-116) Avail: US Patent Office CSCL 21E

A gas turbine is described wherein the thermal stresses in the turbine rotor are reduced. The rotor includes a central disc

with a peripheral rim, and a plurality of blades extending radially outward from the rim. To reduce thermal stresses, a duct arrangement is provided which selectively directs hot gases from the turbine combustor to the rim during the turbine start up. The hot gases from the combustor serve to heat the rim, and decrease the start up period necessary to bring the temperature profile of the rotor into the operating temperature range. After the start up period, the duct arrangement is then used to direct cool gases from the turbine compressor to the rim of the rotor in order to maintain a lower rotor equilibrium temperature.
Official Gazette of the U.S. Patent Office

N79-10058*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
EVALUATION OF THE CYCLIC BEHAVIOR OF AIRCRAFT TURBINE DISK ALLOYS Final Report
B. A. Cowles, D. L. Sims, and J. R. Warren Oct. 1978 152 p refs
(Contract NAS3-20367)
(NASA-CR-159409; PWA-FR-10299) Avail: NTIS HC A08/MF A01 CSCL 21E

Five aircraft turbine disk alloys representing various strength and processing histories were evaluated at 650 C to determine if recent strength advances in powder metallurgy have resulted in corresponding increases in low cycle fatigue (LCF) capability. Controlled strain LCF tests and controlled load crack propagation tests were performed. Results were used for direct material comparisons and in the analysis of an advanced aircraft turbine disk, having a fixed design and operating cycle. Crack initiation lives were found to increase with increasing tensile yield strength, while resistance to fatigue crack propagation generally decreased with increasing strength. Author

N79-10059# Pratt and Whitney Aircraft Group, East Hartford, Conn.
INTERNAL MIXER INVESTIGATION FOR JT8D ENGINE JET NOISE REDUCTION. VOLUME 1: RESULTS Final Report, May 1976 - Jul. 1977
A. B. Packman and D. C. Eiler Dec. 1977 111 p refs 2 Vol.
(Contract DOT-FA76WA-3809)
(AD-A057309; PWA-5582-Vol-1; FAA-RD-77-132-1-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 20/1

A scale model experimental program was conducted to determine the noise reduction and the impact on propulsive performance that would result from installing a multilobed internal mixer on the JT8D engine. Long and short mixer designs were investigated. One-seventh scale mixer models, designed to permit lobe geometry variations, were fabricated and tested along with a model of the JT8D reference exhaust system. The test results indicated that, in general, the long and short mixers produced 3-4 PNdB reduction in peak percaived noise level relative to the reference exhaust system. Exhaust system performance, in terms of improvement in cruise thrust specific fuel consumption and impact on takeoff thrust, was somewhat better for the long mixer than for the short mixer configurations. However, the short mixers offer significant advantages in terms of weight savings and minimized the hardware changes required for installation in the current JT8D engines. Based on the noise and performance test results in conjunction with the installation considerations, a short mixer design was recommended for evaluation in a full scale engine test. Author

N79-10060*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF SINGLE-STAGE AXIAL-FLOW TRANSONIC COMPRESSOR WITH ROTOR AND STATOR ASPECT RATIOS OF 1.19 AND 1.26, RESPECTIVELY, AND WITH DESIGN PRESSURE RATIO OF 1.82
Lonnie Reid and Royce D. Moore Nov. 1978 103 p refs
(NASA-TP-1338; E-9461) Avail: NTIS HC A06/MF A01 CSCL 21E

The overall and blade-element performance of a low-aspect-ratio transonic compressor stage is presented over the stable operating flow range at 70, 90, and 100 percent design speeds. At design speed the rotor and stage achieved peak efficiencies of 0.872 and 0.845 at pressure ratios of 1.875 and 1.842, respectively. The stage stall margin at design speed was 21.8 percent. Author

N79-10061*# Mechanical Technology, Inc., Latham, N. Y.
STUDY OF T53 ENGINE VIBRATION Final Report
Thomas J. Walter Nov. 1978 60 p refs
(Contract NAS3-20609)
(NASA-CR-135449; MTI-78TR66) Avail: NTIS HC A04/MF A01 CSCL 21E

Vibration characteristics for overhauled T53 engines, including rejection rate, principal sources of vibration, and normal procedures taken by the overhaul center to reduce engine vibration are summarized. Analytical and experimental data were compared to determine the engine's dynamic response to unbalance forces with results showing that the engine operates through bending critical speeds. Present rigid rotor balancing techniques are incapable of compensating for the flexible rotor unbalance. A comparison of typical test cell and aircraft vibration levels disclosed significant differences in the engine's dynamic response. A probable spline shift phenomenon was uncovered and investigated. Action items to control costs and reduce vibration levels were identified from analytical and experimental studies. B.B.

N79-10062# Borst (Henry V.) and Associates, Wayne, Pa.
AERODYNAMIC DESIGN AND ANALYSIS OF PROPELLERS FOR MINI-REMOTELY PILOTED AIR VEHICLES. VOLUME 2: DUCTED PROPELLERS Final Report, Jun. 1976 - Mar. 1978
Henry V. Borst May 1978 77 p
(Contract DAAJ02-76-C-0031; DA Proj. 1F2-62209-AH-76)
(AD-A056948; USAAMRDL-TR-77-45B-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report presents the design and analysis of two open propellers and two ducted propellers for use on advanced Remotely Piloted Vehicles, RPV's. One of the two open propellers was designed for use on a direct-drive engine with a maximum rpm of 8000. The other open propeller was designed for a geared engine of the same power output, but with a maximum rpm of 5860. Two ducted propellers were designed for the same engines. The open and ducted propellers were designed based on a procedure that was established for determining the lowest power and rpm to meet the performance requirements at any operating condition. The geometric characteristics of the four propellers designed based on this procedure are presented so that the blades of these propellers can be fabricated. GRA

N79-10063# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
DESIGN AND TEST OF AN ANNULAR STING SUPPORT CONCEPT FOR AFTBODY NOZZLE WIND TUNNEL TESTING Final Report, 1 Jan. 1976 - 1 Sep. 1977
Douglas L. Bowers Apr. 1978 73 p refs Presented at 13th AIAA/SAE Propulsion Conf., 1 Jan. 1976 - 1 Sep. 1977
(AD-A056945; AFFDL-TR-78-26) Avail: NTIS HC A04/MF A01 CSCL 21/5

The annular sting support concept for aftbody nozzle testing supports the model through the exhaust nozzles, provides high pressure air to simulate the exhaust plume to enter the model, and provides a path for instrumentation lines to be routed out of the model. The support concept, experimental model, and supporting analytical studies are described. Experimental data for the aftbody nozzle contours are compared for a free jet test and the annular sting support test. Also the results of an analytical prediction of the nozzle boattail pressure distribution and wind tunnel wall effects are described. Test results and experimental data comparisons indicate that the annular sting support concept offers an alternate testing technique for aftbody nozzles. Author (GRA)

N79-10064# Hughes Helicopters, Culver City, Calif.
ENGINE/AIRFRAME/DRIVE TRAIN DYNAMIC INTERFACE DOCUMENTATION Final Report, Jul. 1977 - Jan. 1978
James F. Needham and Debashis Banerjee May 1978 61 p refs
(Contract DAAJ02-77-C-0035)
(AD-A056956; HH-78-31; USARTL-TR-78-12) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report pertains to engine/airframe/drive train dynamic

interface problems experienced by helicopters and the methodology used to avoid dynamic interface problems. The problem of low torsional frequency of the engine/airframe/drive train dynamic system that results from the design philosophy of using a stationary main rotor mast enclosing a separate 'floating' torque drive shaft is addressed. The use of supercritical shafts and vibration isolators are described and mobility methods to preclude engine/airframe vibration problems are discussed. GRA

N79-10065# Pratt and Whitney Aircraft Group, East Hartford, Conn.
INTERNAL MIXER INVESTIGATION FOR JTBD ENGINE JET NOISE REDUCTION. VOLUME 2: APPENDICES A, B, C, AND D Final Report, May 1976 - Jul. 1977
A. B. Packman and D. C. Eiler Dec. 1977 186 p 2 Vol.
(Contract DOT-FA76WA-3809)
(AD-A057310/5; FAA-RD-77-132-Vol-2; PWA-5582-Vol-2)
Avail: NTIS HC A09/MF A01 CSCL 20/1

The operating condition for each test point of the configurations tested is listed. B.B.

N79-10011# Pratt and Whitney Aircraft, East Hartford, Conn. Commercial Products Div.
AIRCRAFT ENGINE ICING, TECHNICAL SUMMARY
Gordon D. Pfeifer *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 17 p refs (For primary document see N79-10002 01-01)
(Contract DOT-FA76WA-3840)
Avail: NTIS HC A10/MF A01

N79-10013# National Gas Turbine Establishment, Pyestock (England). Engine Test Dept.
ICING TESTS ON TURBOJET AND TURBOFAN ENGINES USING THE NGTE ENGINE TEST FACILITY
R. G. J. Ball and A. G. Prince *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 15 p ref (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

N79-10014# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Helicopter Div.
TESTS UNDER SNOW AND ICING CONDITIONS WITH THE BO 105 ENGINE INSTALLATION
Dieter Bender *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 12 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

N79-10015# National Research Council of Canada, Ottawa (Ontario).
ICING TESTS OF A SMALL GAS TURBINE WITH INERTIAL SEPARATION ANTI-ICING SYSTEM
W. Grabe and D. Tedstone (Pratt and Whitney Aircraft of Can. Ltd., Longueuil Quebec) *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 20 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N79-10066*# National Aeronautics and Space Administration, Washington, D. C.
PIVOTING OUTPUT UNIT CONTROL SYSTEMS ACTIVATED BY JACKS
Pierre Belliere Oct. 1978 13 p Transl. into ENGLISH of French Patent no. 76-06636, 9 Mar. 1976 12 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75581) Avail: NTIS HC A02/MF A01 CSCL 01C

An invention to be used for controlling aircraft flaps is described. It is applicable to control systems with two coaxial output units which pivot simultaneously with respect to two fixed units and which are activated by two opposed, straight coaxial jacks. J.M.S.

N79-10067*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
A FEASIBILITY STUDY OF ORBITER FLIGHT CONTROL EXPERIMENTS
W. H. Geissler Oct. 1978 175 p refs
(Contract NAS1-15141)
(NASA-CR-158952) Avail: NTIS HC A08/MF A01 CSCL 01C

The results of a feasibility study of orbiter flight control experiments performed are summarized. Feasibility studies were performed on a group of 14 experiments selected from a candidate list of 35 submitted to the study contractor by the flight control community. Concepts and requirements were developed for the 14 selected experiments and they were ranked on a basis of technical value, feasibility, and cost. It was concluded that all the selected experiments can be considered as potential candidates for the Orbiter Experiment program, which is being formulated for the Orbiter Flight Tests and subsequent operational flights, regardless of the relative ranking established during the study. None of the selected experiments has significant safety implications and the cost of most was estimated to be less than $200K. G.Y.

N79-10068*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
FLIGHT-DETERMINED STABILITY AND CONTROL DERIVATIVES FOR THE F-111 TACT RESEARCH AIRCRAFT
Alex G. Sim and Robert E. Curry Oct. 1978 78 p refs
(NASA-TP-1350; H-1004) Avail: NTIS HC A05/MF A01 CSCL 01C

A flight investigation was conducted to provide a stability and control derivative data base for the F-111 transonic aircraft technology research aircraft. Longitudinal and lateral-directional data were obtained as functions of Mach number, angle of attack, and wing sweep. For selected derivatives, the flight results were correlated with derivatives calculated based on vehicle geometry. The validity of the angle of attack measurement was independently verified at a Mach number of 0.70 for angles of attack between 3 and 10 degrees. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N79-10069*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
TOW BAR FOR AIRCRAFT Patent Application
Paul Baldridge, inventor (to NASA) Filed 9 Aug. 1978 11 p
(NASA-Case-FRC-11022-1; US-Patent-Appl-SN-932108) Avail: NTIS HC A02/MF A01 CSCL 13I

The tow bar of the instant invention includes a rigid, elongated beam having a hitch located at each of its opposite ends for accommodating a coupling of the tow bar between a gear truck and a towing vehicle. Interposed between the center mass of the tow bar and the end thereof to be connected with a gear truck, there is provided a wheel transport assembly, including wheels which serve as a fulcrum for the tow bar as one end is elevated for facilitating a coupling of the tow bar to a gear truck, and a manually operable hydraulic jack for elevating the opposite end of the beam sufficiently for facilitating a hook-up with a towing vehicle, as well as to clear the transport wheels from engagement with the supporting surface of the aircraft. By employing the tow bar of the instant invention it was found that one man can effect a coupling of the tow bar with a given aircraft in even less time than four to six men. NASA

N79-10070# National Technical Information Service, Springfield, Va.
AIRFIELD PAVEMENT EVALUATION, VOLUME 4. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1975 - Jun. 1978
Guy E. Habercom, Jr. Jul. 1978 190 p Supersedes NTIS/PS-77/0662; NTIS/PS-76/0581
(NTIS/PS-78/0685/4; NTIS/PS-77/0662; NTIS/PS-76/0581) Avail: NTIS HC $28.00/MF $28.00 CSCL 01E

The bibliography contains abstracts of government-sponsored research reports relative to airfield pavement structures. Durability, wear resistance, skid resistance, and surface qualities are analyzed and evaluated. This updated bibliography contains 184 abstracts, 16 of which are new entries to the previous edition. GRA

N79-10071# Inglewood City Dept. of Planning and Development, Calif.
LAX AIRPORT/LAND USE PLANNING STUDY. PHASE 1 REPORT: SHORT TERM NOISE ABATEMENT Final Report
P. Patrick Mann Mar. 1978 44 p
(PB-281622/1; ING-101) Avail: NTIS HC A03/MF A01 CSCL 13B

Short-term aircraft noise abatement strategies involving minimal capital investment were investigated for application to Los Angeles International Airport. The FAA integrated noise model was used to generate a grid map of noise levels. Noise levels were compared with existing land uses in a city-developed grid mapping program. GRA

N79-10072# Aerotherm Acurex Corp., Mountain View, Calif.
JET ENGINE TEST CELLS: EMISSIONS AND CONTROL MEASURES, PHASE 2 Final Report
John Kelly and Edward Chu Apr. 1978 158 p refs
(Contract EPA-68-01-4142)
(PB-282412/6; ACUREX/TR-78/102; EPA-340/1-78-001B) Avail: NTIS HC A08/MF A01 CSCL 13B

Background information is provided on the environmental aspects of uncontrolled and controlled military jet engine test cell operations. The environmental impact of these operations is considered on both a source and an air quality basis. Wet-packed scrubber, jet engine clean combustor, and ferrocene fuel-additive test cell emissions control strategies are described. Clean combustor technology and its associated cost of implementation are discussed in detail. It is estimated that for some jet engine tests, applying clean combustors can cause NOx emissions to rise above local stationary source regulations. The air quality impact of controlled jet engine test cell emissions is small. GRA

N79-10006# National Gas Turbine Establishment, Pyestock (England).
ICING TEST FACILITIES AT THE NATIONAL GAS TURBINE ESTABLISHMENT
R. D. Swift *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 22 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

N79-10007# Centre d'Essais de Propulseurs, Saclay (France).
INSTALLATION OF ICING TESTS [INSTALLATIONS D'ESSAIS DE GIVRAGE]
Jacques Bongrand *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 9 p refs In FRENCH (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

N79-10008# ARO, Inc., Arnold Air Force Station, Tenn.
ENGINE ICING MEASUREMENT CAPABILITIES AT THE AEDC
Jay D. Hunt *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 15 p refs Sponsored in part by AEDC (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

N79-10009# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
MEASUREMENT AND CONTROL OF SIMULATED ENVIRONMENTAL ICING CONDITIONS IN AN OUTDOOR, FREE JET, ENGINE GROUND TEST FACILITY
R. G. Keller *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 13 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N79-10073*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
OFT ASCENT/DESCENT ANCILLARY DATA REQUIREMENTS DOCUMENT
A. C. Bond, Jr. and Bruce Abramson Jul. 1978 38 p ref
(NASA-TM-79905; JSC-14370; Rept-78-FM-40) Avail: NTIS HC A03/MF A01 CSCL 22A

Requirements are presented for the ascent/descent (A/D) navigation and attitude-dependent ancillary data products to be generated for the space shuttle orbiter in support of orbital flight test requirements, MPAD guidance and navigation performance assessment, and the mission evaluation team. It was intended that this document serve as the sole requirements control instrument between MPB/MPAD and the A/D ancillary data users. The requirements are primarily functional in nature, but some detail level requirements are also included. J.A.M.

N79-10074*# National Aeronautics and Space Administration, Washington, D. C.
THE PARTNERSHIP: A HISTORY OF THE APOLLO-SOYUZ TEST PROJECT
Edward Clinton Ezell and Linda Neuman Ezell 1978 570 p refs Original contains color illustrations
(NASA-SP-4209) Avail: NTIS SOD HC CSCL 22A

Correspondance, interviews, official documents, and other published materials were used to trace the evolution of the Apollo Soyuz Test Project from the initial proposal for international cooperation in space use and exploration until the successful completion of the joint Soviet-American mission. Conceptual drawings of proposed docking modules and mechanisms are presented and dicussed. Black and white photographs taken during mission planning and in-flight activities are included with color photographs of the earth taken during the mission. Joint meetings are summarized and the scientific experiments and launch vehicles are discussed in the appendices. A.H.

N79-10075*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A REVIEW OF SATELLITE TIME-TRANSFER TECHNOLOGY: ACCOMPLISHMENTS AND FUTURE APPLICATIONS
Robert S. Cooper and Andrew R. Chi Nov. 1978 27 p refs Presented at the URSI General Assembly, Helsinki, Finland, 1-9 Aug. 1978
(NASA-TM-79652) Avail: NTIS HC A03/MF A01 CSCL 22A

The research accomplishments by NASA in meeting the needs of the space program for precise time in satellite tracking are presented. As a major user of precise time signals for clock synchronization of NASA's worldwide satellite tracking networks, the agency provides much of the necessary impetus for the development of stable frequency sources and time synchronization technology. The precision time required for both satellite tracking and space science experiments has increased at a rate of about one order of magnitude per decade from 1 millisecond in the 1950's to 100 microseconds during the Apollo era in the 1960's to 10 microseconds in the 1970's. For the Tracking and Data Relay Satellite System, satellite timing requirements will be extended to 1 microsecond and below. These requirements are needed for spacecraft autonomy and data packeting. S.B.S.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N79-10076*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
OPTIMUM SATELLITE ORBITS FOR ACCURATE MEASUREMENT OF THE EARTH'S RADIATION BUDGET, SUMMARY
Final Report
G. G. Campbell and T. H. VonderHaar Apr. 1978 65 p refs (Contract NAS1-12106)
(CSU-ATSP-289-US-ISSN-0067-0340) Avail: NTIS HC A04/MF A01 CSCL 22A

The optimum set of orbit inclinations for the measurement of the earth radiation budget from spacially integrating sensor systems was estimated for two and three satellite systems. The best set of the two were satellites at orbit inclinations of 80 deg and 50 deg; of three the inclinations were 80 deg, 60 deg and 50 deg. These were chosen on the basis of a simulation of flat plate and spherical detectors flying over a daily varying earth radiation field as measured by the Nimbus 3 medium resolution scanners. A diurnal oscillation was also included in the emitted flux and albedo to give a source field as realistic as possible. Twenty three satellites with different inclinations and equator crossings were simulated, allowing the results of thousand of multisatellite sets to be intercompared. All were circular orbits of radius 7178 kilometers. B.B.

N79-10077*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBIT TARGETING SPECIALIST FUNCTION: LEVEL C FORMULATION REQUIREMENTS
A. DuPont, S. McAdoo, H. Jones, A. K. Jones, and D. Pearson Aug. 1978 166 p Supersedes Rept-78-FM-27
(NASA-TM-79755; JSC-14393; Rept-78-FM-43; Rept-78-FM-27) Avail: NTIS HC A08/MF A01 CSCL 22A

A definition of the level C requirements for onboard maneuver targeting software is provided. Included are revisions of the level C software requirements delineated in JSC IN 78-FM-27, Proximity Operations Software: Level C Requirements, dated May 1978. The software supports the terminal phase midcourse (TPM) maneuver, braking and close-in operations as well as supporting computation of the rendezvous corrective combination maneuver (NCC), and the terminal phase initiation (TPI). Specific formulation is contained here for the orbit targeting specialist function including the processing logic, linkage, and data base definitions for all modules. The crew interface with the software is through the keyboard and the ORBIT-TGT display. G.G.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N79-10078*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LARGE SPACE SYSTEMS TECHNOLOGY, VOLUME 1
E. C. Naumann, comp. and A. Butterfield, comp. (GE Co.) 1978 540 p Seminar held at Hampton, Va., 17-19 Jan. 1978 2 Vol.
(NASA-CP-2035-Vol-1; L-12068) Avail: NTIS HC A23/MF A01 CSCL 22B

Significant and/or controversial issues related to the design, packaging, transportation, deployment, erection, and on orbit assembly of large space structures and related systems are addressed. Topics cover mission requirements, structural concepts, materials, structural alignment, thermal control, metrology, and technological forecasting. For individual titles, see N79-10079 through N79-10096.

N79-10079*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OVERVIEW OF THE LARGE SPACE SYSTEMS TECHNOLOGY PROGRAM
A. Guastaferro *In its* Large Space Systems Technol., Vol. 1 1978 p 1-17 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

A multicenter management approach which provides the opportunity to work across many disciplines and match the roles and expertise of various NASA facilities is described for the large space system technology (LSST) program which was established to define, develop, and verify structural concepts, analyses, and design procedures for a range of sizes and configurations to be deployed, erected, or fabricated in orbit during projected space missions utilizing shuttle in the 1985 to 2000 time period. Benefits from the program include reduced costs for transporting structures having low mass, high packageability, and multimission capabilities. Technologies identified by the LSST program will contribute to the solutions of problems in other sectors of the economy. A.R.H.

N79-10080*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TECHNOLOGY NEEDS AND OPPORTUNITIES FOR FUTURE NASA MISSIONS
S. R. Sadin *In its* Large Space Systems Technol., Vol. 1 1978 p 19-69 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

The process of forecasting NASA's future needs and missions as well as the technologies relevant to the projected requirements is examined with emphasis on large space system technology. A technology model (set of generic systems) is presented to assist in the development of technology program options, to identify major technology areas requiring concentrated effort, and to serve as an evaluation criteria for current technology programs. The model is applied to considerations of near and far term opportunities for exploration of the universe, global services, utilization of the space environment, and the space transportation system. A.R.H.

N79-10081*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE CREW STATION ASTRONAUT INTERFACES
George C. Franklin *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 71-140 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

The current shuttle orbiter configuration and its crew module and payload bay accomodations for work and off duty activities are described. The capability of the remote manipulator system and provisions to support extravehicular activities are examined with emphasis on flight crew activities for orbital flight tests and for early operational space transportation system flights. Facilities used to verify crew interfaces are also described. A.R.H.

N79-10082*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DESIGNING STRUCTURES FOR LARGE SPACE SYSTEMS
R. H. Christensen *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 141-152 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

A questionnaire was compiled to identify technology deficiencies and point to research and development activities required in support of the large space structures program. Problem areas identified in setting criteria for such structures include improved flightworthiness, satisfying cost constraints, assessing new loads

and environments, improved mission performance and life, and preservation of the ecology. A.R.H.

N79-10083*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ORBITING DEEP SPACE RELAY STATION (ODSRS): DSN FEASIBILITY STUDY REPORT
Tom Thornton and John Hunter *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 153-176 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

Future tracking requirements and advantages over earth based stations justify the design of an orbiting, free flying very long base interferometry system to provide high resolution maps of celestial radio sources. Moderate technology development is required for the following: 30 meter to 60 meter diameter deployable parabolic antennas with less than 2 millimeters surface tolerance; a momentum wheel attitude control system with few arc/second accuracy; solar power design; a hydrogen maser atomic frequency standard; and the cryogenic receivers. The system must meet current Deep Space tracking capabilities as a minimum, and the technology must be compatible with system performance growth in the future. System lifetime must be ten years without major refurbishing. A.R.H.

N79-10084*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HIGH RESOLUTION SOIL MOISTURE RADIOMETER
T. T. Wilheit *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 177-194 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

An electrically scanned pushbroom phased antenna array is described for a microwave radiometer which can provide agriculturally meaningful measurements of soil moisture. The antenna size of 100 meters at 1400 MHz or 230 meters at 611 MHz requires several shuttle launches and orbital assembly. Problems inherent to the size of the structure and specific instrument problems are discussed as well as the preliminary design. A.R.H.

N79-10085*# McDonnell-Douglas Corp., St. Louis, Mo.
DESIGN CONSIDERATIONS FOR LARGE SPACE ANTENNAS
R. Johnson, Jr. *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 195-219 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

Performance requirements and costs for transportation, fabrication, and orbital assembly are the drivers in the design of large space antennas will range in size from approximately 30 m to 1 km in diameter and include radiometers, multibeam lens antennas, and microwave power transmission systems. Research and development is required to define comprehensive structural criteria for specific missions, to determine optimized geometries for truss elements and truss configurations and to establish requirements for joint design with consideration of tolerances, load transfer, thermal compatibility, and assembly and disassembly. Candidate structural elements, materials systems for the low pressure rapid cure of advanced composite materials, and various on orbit assembly and fabrication techniques must also be developed. A.R.H.

N79-10086*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
LARGE ANTENNA STRUCTURE TECHNOLOGIES REQUIRED FOR 1985-2000
W. R. Wannlund *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 221-241 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

Topics discussed include: (1) material degradation as related to graphite composites and thermal control coatings; (2) thermal distortions considering postulated end-of-life conditions for extended lifetime (over 10 years); (3) examination of built-in shape versus actively controlled surfaces; (4) testing philosophy of super large antenna structures; and (5) examination of some possibilities which may require new or different technology. A.R.H.

N79-10087*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
LARGE SPACE DEPLOYABLE ANTENNA SYSTEMS
In NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 243-288 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

The design technology is described for manufacturing a 20 m or larger space erectable antenna with high thermal stability, high dynamic stiffness, and minimum stowed size. The selected approach includes a wrap rib design with a cantilever beam basic element and graphite-epoxy composite lenticular cross section ribs. The rib configuration and powered type operated deploying mechanism are described and illustrated. Other features of the parabolic reflector discussed include weight and stowed diameter characteristics, structural dynamics characteristics, orbit thermal aperture limitations, and equivalent element and secondary (on axis) patterns. A block diagram of the multiple beam pattern is also presented. A.R.H.

N79-10088*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ON SPACE DEPLOYABLE ANTENNAS AND ELECTRONICS: PLANS AND PROGRAMS
T. G. Campbell, W. F. Croswell, T. Deaton, and B. Dobrotin (JPL) *In its* Large Space Systems Technol., Vol. 1 1978 p 289-333 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

Technology plans are presented for developing deployable reflectors having diameters of 30 to 300 meters and surface accuracies of several millimeters for L and X band applications, as well as for the electronic subsystems required for such large structures. An electromagnetic analysis method for predicting the radio frequency performance of large reflectors involves projecting field points onto an aperture plane. The data points in the aperture plane are quantized to produce contours of constant phase and amplitude. Far field patterns are then calculated using reduced computer storage. A.R.H.

N79-10089*# General Dynamics/Convair, San Diego, Calif.
APPLICATION OF GEO-TRUSS ERECTABLE ANTENNA 1985 - 2000 SYSTEMS
John A. Fager *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 335-367 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

The geo-truss concept provides a natural structural element to use in the deployment or fabrication of large systems. Three systems conceptually proposed and discussed are: (1) direct TV broadcast to half-time zone, Alaska dnd Hawaii; (2) deep space communication satellite; and (3) coastal water surveillance radar satellite. A.R.H.

N79-10090*# Space and Missile Systems Organization, Los Angeles Air Force Station, Calif.
USAF ANTENNA ON-ORBIT ASSEMBLY
Paul E. Heartquist *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 369-401 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

Structural concepts, upper stage evaluations, and orbiter packing are discussed for spacecraft having 300 ft to 1000 ft diameter sensors. Techniques are examined for stowing, deploying, and transferring to high earth orbit expandable hex, expanding tetrahedral ring, and fold out truss configurations. Upper stage final candidate configurations and their influence on antenna design selection are discussed. A.R.H.

N79-10091*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEPLOYABLE ANTENNA DEMONSTRATION STUDY
Wilbur Thompson and Jack Schultz (Grumman Aerospace) *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 403-439 (For primary document see N79-10078 01-15)
(Contract NAS8-32394)
Avail: NTIS HC A23/MF A01 CSCL 22B

A demonstration system and shuttle flight program was

defined to demonstrate packaging, transportation, erection, and structural integrity of a large deployable antenna concept. An analysis of deployable antenna requirements indicates that (1) erectable structures are clearly applicable to very high precision (above 50 GHz) antennas (10 to 30 m); (2) deployable structures are light weight, applicable to moderate precision (below 14 GHz) large antennas (up to 300 m); and (3) both deployable and erectable apply to small and large antenna platforms with common utilities. A.R.H.

N79-10092*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TECHNOLOGY FOR ACCURATE SURFACE AND ATTITUDE CONTROL OF A LARGE SPACEBORNE ANTENNA AND MICROWAVE SYSTEM
John B. Dahlgren *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 441-456 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

Problems associated with controlling a large diameter (200 - 300 m) spaceborne antenna and microwave system operating at frequencies in the range from 20 GHz to at least 300 GHz are addressed. Such large structures must point to any new target and settle in one hour, and have control surface accuracy to 50 microns rms. Critical technologies required to enable system development by 1990 to 2000 for radio/ radar astronomy, orbiting Deep Space rela satellite, SETI, very long base interferometry, and earth looking radiometry applications are discussed. A.R.H.

N79-10093*# TRW Systems Group, Redondo Beach, Calif. Control and Sensor Systems Lab.
INFLIGHT OPTICAL MEASUREMENT OF ANTENNA SURFACES
R. S. Neiswander *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 457-489 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

A technology base was developed for a wide variety of applications oriented sensors to meet requirements for the fabrication, assembly, test, surface figure monitoring, and ultimately surface figure active control of large space antennas. An optical sensor technique is described which establishes an ideal centerline at each beam during fabrication or later during assembly. Deviations from the centerline, either in lateral deformation or in twist, are measured to produce limit warnings or to evoke active control at the building machine. A.R.H.

N79-10094*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STRUCTURAL ALIGNMENT SENSOR
L. Davis, N. E. Buholz, C. W. Gillard, C. C. Huang, and W. M. Wells, III *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 491-505 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

Comparative Michelson interferometers are discussed as well as the operating range potential of a structural alignment sensor (SAS) which requires only one laser mode. Schematics are presented for the distance measurement logic, the basic SAS system, the SAS optical layout, the coarse measurement signal processor, and the measured range resolution. A.R.H.

N79-10095*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FUTURE LARGE SPACE SYSTEMS OPPORTUNITIES: A CASE FOR SPACE-TO-SPACE POWER?
L. B. Garrett and W. R. Hook *In its* Large Space Systems Technol., Vol. 1 1978 p 507-531 (For primary document see N79-10078 01-15)
Avail: NTIS HC A23/MF A01 CSCL 22B

Applications and options for beaming power to near-earth space users from a central space power platform are examined. The cost effectiveness of on-board versus remote power transfer is examined for orbital transfer propulsion systems. Performance characteristics are projected for advanced power generation, transmission, and receiver systems for the 1990's. Major technological development needs are identified with particular emphasis on large space systems technology. A.R.H.

N79-10096*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POST LANDSAT D ADVANCED CONCEPT EVALUATION
F. S. Flatow and L. D. Alexander (GE Co.) *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 1 1978 p 533-567 (For primary document see N79-10078 01-15) (Contract NAS2-9580)
Avail: NTIS HC A23/MF A01 CSCL 22B

Preliminary results of a past LANDSAT D advanced concept evaluation study to forecast and identify key technologies required for earth resources satellite systems in the 1985 to 2000 time period are presented. Mission categories discussed include agriculture, range management, forestry, geological resources, land use, water resources, environmental quality, and disaster assessment. Sensor and system concepts are described for a passive L-band radiometer (microsat), a texturometer to measure ground surface texture, and a ferris wheel radar configuration that relies on cable tension for support. A.R.H.

N79-10097*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LARGE SPACE SYSTEMS TECHNOLOGY, VOLUME 2
E. C. Naumann, comp. and A. Butterfield, comp. 1978 505 p Seminar held at Hampton, Va., 17-19 Jan. 1978 2 Vol. (NASA-CP-2035-Vol-2; L-12068-Vol-2) Avail: NTIS HC A22/MF A01 CSCL 22B

The proceedings of a seminar which was held to discuss the status of space technology and to plan the development of new technology for large space systems are presented. For individual titles, see N79-10098 through N79-10113.

N79-10098*# Rockwell International Corp., Downey, Calif. Space Div.
EQUIPMENT INSTALLATION ON LARGE AREA SPACE SYSTEMS
E. Katz *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 2 1978 p 569-596 (For primary document see N79-10097 01-15)
Avail: NTIS HC A22/MF A01 CSCL 22B

The requirements and concepts for the installation of various types of mission and subsystem equipment on large area space systems are discussed. L.S.

N79-10099*# Boeing Aerospace Co., Seattle, Wash.
STRUCTURAL/THERMAL CONSIDERATIONS FOR DESIGN OF LARGE SPACE PLATFORM STRUCTURES
D. L. Barclay, E. W. Brogren, and D. E. Skoumal *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 2 1978 p 597-626 (For primary document see N79-10097 01-15)
Avail: NTIS HC A22/MF A01 CSCL 22B

A method is described for placing a large, STS-compatible platform on orbit utilizing a construction method employing both deployable and erectable structures. A multifunctional mechanism is used for deployable structures and an on-orbit assembly is used for erectable structures. Also analyses are discussed which assess the thermal distortion of a simple open truss and a more complex truss. L.S.

N79-10100*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EFFICIENT CONCEPTS FOR LARGE ERECTABLE SPACE STRUCTURES
M. F. Card, H. G. Bush, W. L. Heard, Jr., and M. M. Mikulas, Jr. *In its* Large Space Systems Technol., Vol. 2 1978 p 627-656 (For primary document see N79-10097 01-15)
Avail: NTIS HC A22/MF A01 CSCL 22B

The status of Langley Research Center development of the nestable column concept is reviewed including results of member and truss component tests, and planned assembly studies. In addition, more recent studies of alternative member concepts are presented. Preliminary results on relative efficiency of several types of truss-type columns are compared and future test plans discussed. L.S.

N79-10101*# General Dynamics/Convair, San Diego, Calif.
SPACE FABRICATION AND ASSEMBLY OF GRAPHITE COMPOSITE TRUSSES
D. J. Powell *In* NASA. Langley Res. Center Large Space

Systems Technol., Vol. 2 1978 p 657-681 (For primary document see N79-10097 01-15)
(Contracts NAS8-32471; NAS9-15310)
Avail: NTIS HC A22/MF A01 CSCL 22B

The structural and thermodynamic parameters of constructing and erecting graphite composite trusses in space are discussed. L.S.

N79-10102*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MSFC PRESENTATION CHARTS ON GEOSTATIONARY PLATFORM
William T. Carey, Jr. *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 2 1978 p 683-705 (For primary document see N79-10097 01-15)
Avail: NTIS HC A22/MF A01 CSCL 22B

A concept is presented of a geostationary platform. The concept takes the form of antennas and other payloads mounted on a strongback structure. The utilization and benefits of the platform are discussed. L.S.

N79-10103*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GEOSTATIONARY PLATFORM STRUCTURAL SYSTEM
S. J. Denton *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 2 1978 p 707-749 (For primary document see N79-10097 01-15)
Avail: NTIS HC A22/MF A01 CSCL 22B

A discussion is presented on the following engineering considerations for a geostationary platform: (1) structural configuration and design, (2) thermal characteristics, (3) flight load considerations and (4) assembly approaches. L.S.

N79-10104*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SYSTEM DYNAMICS AND SIMULATION OF LSS
R. F. Ryan *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 2 1978 p 751-774 (For primary document see N79-10097 01-15)
Avail: NTIS HC A22/MF A01 CSCL 22B

Large Space Structures have many unique problems arising from mission objectives and the resulting configuration. Inherent in these configurations is a strong coupling among several of the designing disciplines. In particular, the coupling between structural dynamics and control is a key design consideration. The solution to these interactive problems requires efficient and accurate analysis, simulation and test techniques, and properly planned and conducted design trade studies. The discussion presented deals with these subjects and concludes with a brief look at some NASA capabilities which can support these technology studies. L.S.

N79-10105*# Boeing Aerospace Co., Seattle, Wash.
APPLICABILITY OF THERMOPLASTIC COMPOSITES FOR SPACE STRUCTURES
J. T. Hoggatt and M. Kushner *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 2 1978 p 775-832 (For primary document see N79-10097 01-15)
Avail: NTIS HC A22/MF A01 CSCL 22B

The discussion defines a thermoplastic resin and compares the structural and environmental properties and the fabrication and repairability of the thermoplastic composite with a typical epoxy composite. Low labor costs exhibited by the thermoplastic composites make them a priority consideration for use in space structure. L.S.

N79-10106*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPACECRAFT CHARGING AND PLASMA INTERACTION IMPLICATIONS FOR LARGE SPACE SYSTEMS
E. Miller, M. Stauber, M. Rossi, and W. Fischbein *In its* Large Space Systems Technol., Vol. 2 1978 p 833-865 (For primary document see N79-10097 01-15)
Avail: NTIS HC A22/MF A01 CSCL 22B

Specific discharge mechanisms, plasma interactions, and scale effects associated with very large spacecraft are studied. The large area, low density character, and extensive use of non-conducting materials is thought to have a major impact on the performance and survivability of many large space systems. L.S.

N79-10107*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MATERIALS TECHNOLOGY DEVELOPMENT FOR LONG LIFE LARGE SPACE SYSTEMS
Raymond L. Gause *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 2 1978 p 867-901 (For primary document see N79-10097 01-15)
Avail: NTIS HC A22/MF A01 CSCL 22B

Large Space Systems materials requirements are discussed in terms of types of materials, critical properties, and environmental stability. An outline is given of the materials technology development that will be needed to meet these requirements. L.S.

N79-10108*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LARGE STRUCTURE CONTROL DEVELOPMENT CONCEPTS
G. Rodriguez *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 2 1978 p 903-934 (For primary document see N79-10097 01-15)
Avail: NTIS HC A22/MF A01 CSCL 22B

Viewpoints are presented on large structure control evolving from the solar sail study conducted at JPL. The objective is to make optimum use of insights gained in the study in order to assess required large structure control developments. L.S.

N79-10109*# Rockwell International Corp., El Segundo, Calif.
CONTROL CONCEPTS FOR LARGE SPACE STRUCTURES
R. C. Quartararo *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 2 1978 p 935-957 (For primary document see N79-10097 01-15)
Avail: NTIS HC A22/MF A01 CSCL 22B

A comprehensive program to develop the required control technology was started at Rockwell International's Space Division. A few of the concepts under consideration for attitude, figure, and vibration control of large, flexible space systems are highlighted. In addition, an overview of the Space Division's independent research and development (IR&D) is presented. The direction of the IR&D program was influenced by requirements for electro-optical systems, shuttle erectable structures and satellite power stations. L.S.

N79-10110*# General Dynamics/Convair, San Diego, Calif.
LARGE SPACE PLATFORM CONTROL AVIONICS CONSIDERATIONS
Jack G. Fisher *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 2 1978 p 959-987 refs (For primary document see N79-10097 01-15)
(Contracts NAS9-15310; F04701-77-C-0178)
Avail: NTIS HC A22/MF A01 CSCL 22B

A number of areas requiring technology efforts are identified. Some of these areas associated with the avionics-oriented technologies required for design and operation of many of these large spacecraft are discussed. L.S.

N79-10111*# Boeing Aerospace Co., Seattle, Wash.
MANEUVERING AND POINTING FLEXIBLE VEHICLES
Douglas C. Fosth *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 2 1978 p 988-1020 (For primary document see N79-10097 01-15)
Avail: NTIS HC A22/MF A01 CSCL 22B

With the development of techniques to assemble large structures in orbit, new control system problems evolve. These large structures are typically characterized by lower structural frequencies, but no compromises are made regarding maneuver and structural settling times. Techniques are discussed which will allow these large structures to be maneuvered and pointed quickly with minimum settling times. L.S.

N79-10112*# General Electric Co., Philadelphia, Pa. Re-entry and Environmental Systems Div.
THE PRECISION SELF-METERING STRUCTURE (PSMS)
W. C. Yager *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 2 1978 p 1021-1055 (For primary document see N79-10097 01-15)

Avail: NTIS HC A22/MF A01 CSCL 22B

Large, precise space systems such as space lasers, space telescopes, and space power transmitters cannot be realized until certain fundamental meteorological problems are first solved. It must be shown: (1) how a spatially distributed system of elements can be tied together in terms of a master coordinate system, (2) how master coordinates for these distributed elements can be determined with great accuracy, and (3) how mechanical integration of the elements to desired master coordinates of such accuracy can be achieved. Solutions to these problems are discussed. L.S.

N79-10113*# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.

ELECTRICAL POWER LOSS FROM HIGH-VOLTAGE POWER CIRCUITS THROUGH PLASMA LEAKAGE

Henry Oman *In* NASA. Langley Res. Center Large Space Systems Technol., Vol. 2 1978 p 1057-1070 (For primary document see N79-10097 01-15)

Avail: NTIS HC A22/MF A01 CSCL 22B

Methods are proposed for constructing a solar power satellite system which would decrease electric current leakage through plasma. L.S.

N79-10114# Army Missile Research and Development Command, Redstone Arsenal, Ala.

COHERENT OPTICAL CORRELATION IN REAL TIME FOR MISSILE TERMINAL GUIDANCE

Charles R. Christensen, Juris Upatnieks, and Bobby D. Guenther Jun. 1978 15 p refs

(AD-A056421) Avail: NTIS HC A02/MF A01 CSCL 17/8

The use of area correlation in terminal guidance requires that the system cross correlate a stored reference with the observed scene and have the capacity for handling variations in aspect angle, rotation, scale and intensity. This correlation must be made in real time at a low false alarm rate. Digital techniques can accomplish the preceding requirements but have several limiting characteristics. The number of resolution elements that can be processed is limited by the available core memory. Even with well-chosen algorithms, a large number of multiplications and additions are required and these increase with the number of resolution elements. Parallel processing can reduce the time required to perform this very large number of operations but requires increased complexity and cost. GRA

N79-10115# Harry Diamond Labs., Adelphi, Md.

SKYNET APPLICATIONS SOFTWARE PACKAGE (SASP) PROGRAMMER'S HANDBOOK

Walter J. Scott and John R. Hiller Nov. 1977 112 p refs Sponsored by DNA

(AD-A057116; HDL-TR-1828) Avail: NTIS HC A06/MF A01 CSCL 22/2

The objective of the Defense Nuclear Agency (DNA) sponsored SKYNET program is to develop a methodology for the assessment of satellite vulnerability to system generated electromagnetic pulse (SGEMP) effects from nuclear weapons. The approach includes a study of basic phenomenology and development of cost-effective simulation techniques, as well as improving SGEMP instrumentation and data acquisition and recording techniques. This report summarizes the software developed to acquire and reduce SGEMP data on satellite models for the SKYNET project. Included are comprehensive descriptions of the tasks, subroutines, and common areas. Accompanied by the source and task builder listings and the companion volume titled SKYNET Applications Software Package (SASP) Operator's and User's Handbook, this material provides the reader with a detailed explanation of the SGEMP Transportable Automated Recording System (STARS) operation. Author (GRA)

N79-10948*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PLANNING FOR AIRPORT ACCESS: AN ANALYSIS OF THE SAN FRANCISCO BAY AREA. THREE SUBSYSTEM DESIGNS

In its Planning for Airport Access May 1978 p 189-250 refs (For primary document see N79-10942 01-85)

Avail: NTIS HC A13/MF A01 CSCL 22B

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N79-10116*# McDonnell-Douglas Astronautics Co., Houston, Tex.

REMOTE MANIPULATOR SYSTEM FLEXIBILITY ANALYSIS PROGRAM: MISSION PLANNING, MISSION ANALYSIS, AND SOFTWARE FORMULATION

L. Kumar 10 Aug. 1978 50 p refs

(Contract NAS9-15550)

(NASA-CR-151830; Paper-1.4-7-245) Avail: NTIS HC A03/MF A01 CSCL 22A

A computer program is described for calculating the flexibility coefficients as arm design changes are made for the remote manipulator system. The coefficients obtained are required as input for a second program which reduces the number of payload deployment and retrieval system simulation runs required to simulate the various remote manipulator system maneuvers. The second program calculates end effector flexibility and joint flexibility terms for the torque model of each joint for any arbitrary configurations. The listing of both programs is included in the appendix. A.R.H.

N79-10117*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

TDRSS SYSTEM CONFIGURATION STUDY FOR SPACE SHUTTLE PROGRAM Final Report

Jun. 1978 117 p

(Contract NAS9-15303)

(NASA-CR-151751) Avail: NTIS HC A06/MF A01 CSCL 22B

This study was set up to assure that operation of the shuttle orbiter communications systems met the program requirements when subjected to electrical conditions similar to those which will be encountered during the operational mission. The test program intended to implement an integrated test bed, consisting of applicable orbiter, EVA, payload simulator, STDN, and AF/SCF, as well as the TDRSS equipment. The stated intention of Task 501 Program was to configure the test bed with prototype hardware for a system development test and production hardware for a system verification test. In case of TDRSS when the hardware was not available, simulators whose functional performance was certified to meet appropriate end item specification were used. J.A.M.

N79-10118*# Texas Univ. at Austin. Dept. of Aerospace Engineering and Engineering Mechanics.

EFFECT OF STEP AND/OR GAP TILE MISALIGNMENT ON SHUTTLE TRANSITION

John J. Bertin and Alan Keisner Jun. 1978 53 p refs

(Contract NAS9-13680)

(NASA-CR-151833; Rept-78003) Avail: NTIS HC A04/MF A01 CSCL 01A

The effect of tile misalignment, simulating both step type and gap type misalignment was determined on transition locations in the plane of symmetry of the shuttle orbiter. Data were obtained in a closed circuit hypersonic tunnel with a 50-in. diameter test section providing a Mach number of 8 over a range of pressure levels from 345,000 N/sq m (50 psi) to 620 million N/sq m (900 psi). The stagnation temperature is sufficient to avoid air liquefaction in the test section. B.B.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N79-10119* National Aeronautics and Space Administration, Washington, D. C.

PROGRESS SATELLITE: AN AUTOMATIC CARGO SPACECRAFT

N. Novikov Oct. 1978 10 p Transl. into ENGLISH from Aviat. Kosmonaut. (Moscow), no. 7, Jul. 1978 p 36-37 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-75575) Copyright. Avail: NTIS HC A02/MF A01 CSCL 22B

The requirement for resupplying long term orbital space stations is discussed. The operation of Progress (an unmanned automatic resupply spacecraft) is described. It concludes that the development of Progress is a major contribution of Soviet science to domestic and world aeronautics. J.S.

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-10120*# Xerox Electro-Optical Systems, Pasadena, Calif. Electronic Systems Div.

INERT GAS ION SOURCE PROGRAM Final Report, 2 Mar. 1977 - 2 Jan. 1978

William D. Ramsey 13 Jul. 1978 76 p refs

(Contract NAS3-20393)

(NASA-CR-159423; XEOS-2361) Avail: NTIS HC A05/MF A01 CSCL 21C

THe original 12 cm hexagonal magneto-electrostatic containment discharge chamber has been optimized for argon and xenon operation. Argon mass utilization efficiencies of 65 to 77 percent were achieved at keeper-plus-main discharge energy consumptions of 200 to 458 eV/ion, respectively. Xenon performance of 84 to 96 percent mass utilization was realized at 203 to 350 eV/ion. The optimization process and test results are discussed. G.G.

N79-10121*# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemical Lab.

ROCKET EFFLUENT: ITS ICE NUCLEATION ACTIVITY AND RELATED PROPERTIES Final Report

Farn P. Parungo and Paul A. Allee 1978 29 p refs

(NASA Order T-9246-F)

(NASA-CR-151829) Avail: NTIS HC A03/MF A01 CSCL 04A

To investigate the possibility of inadvertent weather modification from rocket effluent, aerosol samples were collected from an instrumented aircraft subsequent to the Voyager 1 and 2 launches. The aerosol's morphology, concentration, and size distribution were examined with an electron microscope. The elemental compositions of individual particles were analyzed with an X-ray energy spectrometer. Ice nucleus concentration was measured with a thermal diffusion chamber. The particles' physical and chemical properties were related to their ice nucleation activity. A laboratory experiment on rocket propellant exhaust was conducted under controlled conditions. Both laboratory and field experimental results indicated that rocket propellant exhaust can produce active ice nuclei and modify local weather in suitable meteorological conditions. Author

N79-10122*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FUTURE ORBITAL POWER SYSTEMS TECHNOLOGY REQUIREMENTS

Sep. 1978 195 p refs Symp. held at Cleveland, 31 May - 1 Jun. 1978

(NASA-CP-2058; E-9713) Avail: NTIS HC A09/MF A01 CSCL 10A

NASA is actively involved in program planning for missions requiring several orders of magnitude, more energy than in the past. Therefore, a two-day symposium was held to review the technology requirements for future orbital power systems. The purpose of the meeting was to give leaders from government and industry a broad view of current government supported technology efforts and future program plans in space power. It provided a forum for discussion, through workshops, to comment on current and planned programs and to identify opportunities for technology investment. Several papers are presented to review the technology status and the planned programs. For individual titles, see N79-10123 through N79-10143.

N79-10123*# National Aeronautics and Space Administration, Washington, D. C.

OAST SPACE POWER TECHNOLOGY PROGRAM

Jerome P. Mullin *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 1-16 (For primary document see N79-10122 01-20)

Avail: NTIS HC A09/MF A01 CSCL 10A

The current research and technology (R and T) base program is first described, then special attention is directed toward outlining a new system technology specifically oriented toward providing the utility power plant technology base for semi-permanent earth orbital facilities expected to be needed in the middle to late 1980's. The R and T program involves five areas of research: (1) photovoltaic energy conversion; (2) chemical energy conversion and storage; (3) thermal-to-electric conversion; (4) environment interactions; and (5) power systems management and distribution. The general objectives and planned direction of efforts in each of these areas is summarized. G.Y.

N79-10124*# National Aeronautics and Space Administration, Washington, D. C.

OAST SYSTEM TECHNOLOGY PLANNING

Stanley R. Sadin *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 17-39 (For primary document see N79-10122 01-20)

Avail: NTIS HC A09/MF A01 CSCL 10A

The NASA Office of Aeronautics and Space Technology

developed a planning model for space technology consisting of a space systems technology model, technology forecasts and technology surveys. The technology model describes candidate space missions through the year 2000 and identifies their technology requirements. The technology surveys and technology forecasts provide, respectively, data on the current status and estimates of the projected status of relevant technologies. These tools are used to further the understanding of the activities and resources required to ensure the timely development of technological capabilities. Technology forecasting in the areas of information systems, spacecraft systems, transportation systems, and power systems are discussed. G.Y.

N79-10125*# Aerospace Corp., El Segundo, Calif.
HISTORICAL AND PROJECTED POWER REQUIREMENTS
Malcolm G. Wolfe *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 41-69 refs (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

Policy planning for projected space power requirements is discussed. Topics of discussion cover: (1) historical space power trends (prime power requirements and power system costs); and (2) two approaches to future space power requirements (mission/traffic model approach and advanced system scenario approach). Graphs, tables, and flow charts are presented. G.Y.

N79-10126*# National Aeronautics and Space Administration, Washington, D. C.
OVERVIEW OF OFFICE OF SPACE TRANSPORTATION SYSTEMS FUTURE PLANNING
Melvyn Savage and J. William Haughey *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 71-92 (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

The Space Transportation Systems' key milestones as well as the future planning of the Office of Space Transportation Systems are summarized. A brief description and identification of candidate new starts with target development initiation and first flight dates are included. G.Y.

N79-10127*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
MILITARY NEEDS FOR ORBITAL POWER
L. D. Massie, R. R. Barthelemy, and E. T. Mahefkey *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 93-107 refs (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

Results of the DoD/ERDA (now Department of Energy) Space Power Study completed in October 1977 are presented. The major new thrust of Air Force Advanced Technology Plans center on the development of military solar power systems which will extend capabilities to the 10 - 50 KW sub e power range for new classes of missions while maintaining technology applicability to the 0.5 - 10 KW sub e present mission class. The status of FY78 efforts for Project 682J (Air Force Space Power Advanced Development Program) are reported. Project 682J is divided into the following tasks: (1) high efficiency solar panel; (2) nickel-hydrogen battery; (3) gallium arsenide solar concentrator hardness study; and (4) new-start nuclear dynamic power system applications/integration study. G.Y.

N79-10128*# National Aeronautics and Space Administration, Washington, D. C.
SATELLITE POWER SYSTEMS PROGRAM
Ralph I. LaRock *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 107-111 (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

The Department of Energy and NASA are engaged in an intense three-year analysis to determine what course of action the Federal government should pursue relative to this nonconventional energy system. Information is presented in the form of charts for the following: (1) program organization; (2) major program milestones; (3) activity schedule for the program; (4) preliminary baseline comparison by two Systems Definition Centers; and (5) program definition plan (funding by agency management responsibility). G.Y.

N79-10129*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALTERNATIVE POWER-GENERATION SYSTEMS
Robert E. English *In its* Future Orbital Power Systems Technol. Requirements Sep. 1978 p 113-131 refs (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

The present state of the art of thermal power systems is surveyed. Because of the great potential variety of thermal power systems, the heat sources, the power conversion systems, and the integration of thermal power systems with missions are treated sequentially. G.Y.

N79-10130*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A BRIEF SURVEY OF THE SOLAR CELL STATE-OF-THE-ART
Daniel T. Bernatowicz *In its* Future Orbital Power Systems Technol. Requirements Sep. 1978 p 133-146 refs (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

Modern high performance cells made for space are discussed. The major recent developments that are expected to influence what solar cells will be available in five years or so are described. G.Y.

N79-10131*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOLAR ARRAY SYSTEMS
William L. Crabtree *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 147-155 (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

The recent past, present state-of-the-art, and future needs in the area of large photovoltaic solar arrays are discussed. In the past most attention was focused upon performance whereas in the future most of the effort should go into cost reduction. Suggestions are made regarding possible approaches to reducing cost such as on-orbit maintenance, extended lifetime, solar concentrators, and high-voltage modular concepts. G.Y.

N79-10132*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TECHNOLOGY STATUS: BATTERIES AND FUEL CELLS
J. Stuart Fordyce *In its* Future Orbital Power Systems Technol. Requirements Sep. 1978 p 157-166 refs (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

The current status of research and development programs on batteries and fuel cells and the technology goals being pursued are discussed. Emphasis is placed upon those technologies relevant to earth orbital electric energy storage applications. G.Y.

N79-10133*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
TECHNOLOGY STATUS: FUEL CELLS AND ELECTROLYSIS CELLS
Hoyt McBryar *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 167-194 refs (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

The status of the baselined shuttle fuel cell as well as the acid membrane fuel cell and space-oriented water electrolysis technologies are presented. The more recent advances in the alkaline fuel cell technology area are the subject of a companion paper. A preliminary plan for the focusing of these technologies towards regenerative energy storage applications in the multi-hundred kilowatt range is also discussed. G.Y.

N79-10134*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POWER MANAGEMENT AND CONTROL FOR SPACE SYSTEMS
Robert C. Finke, Ira T. Myers, Fred F. Terdan, and N. John Stevens *In its* Future Orbital Power Systems Technol. Require-

ments Sep. 1978 p 195-207 (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

Power management and control technology for the large, high-power spacecraft of the 1980's is discussed. Systems weight optimization that indicate a need for higher bus voltages are shown. Environmental interactions that are practical limits for the maximum potential on exposed surfaces are shown. A dual-voltage system is proposed that would provide the weight savings of a high-voltage distribution system and take into account the potential environmental interactions. The technology development of new components and circuits is also discussed. G.Y.

N79-10135*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LASER POWER TRANSMISSION FOR SPACE POWER AND PROPULSION
Lott W. Brantley *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 209-211 (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

An early status report is presented for a review being made of the state of development of major components and subsystems required for ground-to-space, space-to-space, or space-to-ground laser power transmission for electric or thermal power or propulsion. System characteristics are being evaluated from an applications viewpoint, and major problem areas are being identified. The object is to identify a rewarding first application of lasers for space power and propulsion. An evolution of laser power transmission capabilities over the next 20 years is projected. Supporting technology requirements are to be identified, priorities set, and continued developments coordinated with other government agencies. G.Y.

N79-10136*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SPACECRAFT ACTIVE THERMAL CONTROL TECHNOLOGY STATUS
Wilbert E. Ellis *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 213-233 refs (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 22B

Four advanced space radiator concepts that were pursued in an integrated effort to develop multi-mission-use and low cost heat rejection systems which can overcome the limitations of current radiator systems are briefly discussed and described. Also, in order to establish a firm background to compare the advanced space radiator concepts, the Orbiter active thermal control system is also briefly described. G.Y.

N79-10137*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POWER MODULES AND PROJECTED POWER SYSTEMS EVOLUTION
Lott W. Brantley *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 235-246 (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

Photovoltaic, solar thermal, and nuclear power systems are considered to supply future earth orbital electrical power requirements. A growth scenario from a 25-kW Power Module in the early Shuttle era to the 5- to 10-GW Satellite Power System in the year 2000 is presented. Photovoltaic systems are presently baselined in this evolution. The Photovoltaic Power System and subsystem growth projections, consistent with this scenario, were developed and are summarized. G.Y.

N79-10138*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
JSC SPACE BASE/POWER MODULE STUDIES
Jerry W. Craig *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 247-264 (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

Users of the Orbiter/Spacelab combination will require both higher electrical power and longer duration than is available with the current baseline system. Present Orbiter/Spacelab mission capability is primarily constrained by the hydrogen and oxygen available to generate power in the Orbiter fuel cells. It is also necessary to assure that considerable attitude or point flexibility is retained to assure efficient operation of the Orbiter radiator cooling system. Beyond these early limitations, it is foreseen that orbital operations will eventually need even greater quantities of the basic space utilities: electrical power; heat rejection; and attitude control. Such operations, forecasted for the mid to late 1980's, will be best accommodated by a module stored in orbit that can furnish these to a docked Orbiter/Spacelab or other vehicles. The Orbital Service Module concept to provide for these services is presented. G.Y.

N79-10139*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ECONOMICAL APPROACH TO SPACE POWER SYSTEMS
Fred Teren *In its* Future Orbital Power Systems Technol. Requirements Sep. 1978 p 265-270 (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

Projected energy demand for all NASA, DoD and civil missions for the time span 1981 to 1995 are illustrated. Typical energy cost range from about $300 to $2000 per kW-hr, with an average of about $800 per kW-hr for long-duration missions. At these levels, the cost of the required energy would be several billion dollars per year by about 1985 and might constrain the number and types of NASA programs to be carried out. NASA is extensively pursuing approaches for reducing nonrecurring costs. Two programs are presented for the development of an economical approach to space power systems. They are: (1) Economical Orbital Power (ECOP) with the objective to demonstrate the applicability of a commercial approach to the development of a low cost photovoltaic space power system; and (2) Space Power Experiment (SPEX) which has the objective to demonstrate the application of industrial hardware for space power systems. G.Y.

N79-10140*# Aerospace Corp., Los Angeles, Calif.
PHOTOVOLTAIC POWER SYSTEMS WORKSHOP
Harrison J. Killian and Ronald W. Given (Lockheed Missiles and Space Co., Inc., Morgan Hill, Calif.) *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 271-273 (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

Discussions are presented on apparent deficiencies in NASA planning and technology development relating to a standard power module (25-35 kW) and to future photovoltaic power systems in general. Topics of discussion consider the following: (1) adequate studies on power systems; (2) whether a standard power system module should be developed from a standard spacecraft; (3) identification of proper approaches to cost reduction; (4) energy storage avoidance; (5) attitude control; (6) thermal effects of heat rejection on solar array configuration stability; (7) assembly of large power systems in space; and (8) factoring terrestrial photovoltaic work into space power systems for possible payoff. G.Y.

N79-10141*# Spectrolab, Inc., Sylmar, Calif.
SOLAR CELL WORKSHOP
Eugene L. Ralph *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 275-277 (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

The workshop addressed three issues in respect to the NASA solar cell technology requirements for future orbital missions. First, technology areas were identified that were considered most significant and the deficiencies and concerns that were had with each area are indicated. Second, the tasks that should be undertaken to reduce the costs and risks of future orbital power systems are recommended. Third, an attempt to identify the lowest priority items in the present program in terms of content and timing are made. G.Y.

N79-10142*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
SOLAR ARRAY WORKSHOP
Paul Goldsmith *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 279-282

(For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10A

The solar workshop began with a review of the needs and objectives in this area as presented by the various government representatives during the preceding sessions. The major problem noted with respect to needs was the potentially conflicting requirements of low cost and low weight. Since the importance of weight and cost and relationship between them are strongly mission dependent, the workshop concluded that the requirements of military missions in synchronous orbit could be quite different from the requirements of NASA low-orbit missions and that an assignment of specific technology deficiencies could only be related to specific mission classes. G.Y.

N79-10143*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BATTERY WORKSHOP
Richard H. Sparks (TRW Defense and Space Systems, Redondo Beach, Calif.) and Floyd E. Ford *In* NASA. Lewis Res. Center Future Orbital Power Systems Technol. Requirements Sep. 1978 p 283-287 (For primary document see N79-10122 01-20)
Avail: NTIS HC A09/MF A01 CSCL 10C

The workshop was attended by representatives from industry and government. The requirements for energy storage and the plans for battery development were reviewed. The workshop followed a debate format, with the objective of recommending improvements to the development plans presented by NASA and the Air Force. The issues addressed were: (1) significant technology deficiencies which can be identified; (2) adequacy of current and proposed programs to resolve the technology deficiencies identified; (3) additional tasks which should be undertaken, including benefits and timing; and (4) lowest priority items in the presently planned program, both in content and in timing. G.Y.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N79-10144*# Ultrasystems, Inc., Irvine, Calif.
PREPARATION OF LINEAR HYDROXY SUBSTITUTED POLYPHOSPHAZENES Final Report
K. L. Paciorek, T. I. Ito, and R. H. Kratzer Oct. 1978 40 p refs
(Contract NAS2-8469)
(NASA-CR-152182; SN-8275-F) Avail: NTIS HC A03/MF A01 CSCL 07C

The synthesis of partially hydroxy-substituted phosphazene prepolymers amenable to processing into cellular, flexible polyurethane foams was investigated. Factors determined include (1) the environment of the hydroxyl group; (2) the ease of the hexachlorocyclotriphosphazene polymerization; (3) the nature of the nonreactive substituents; and (4) the mode of introduction of the hydroxyl entity. The specific approaches taken, the rationale of the selections made, and the results are discussed. A.R.H.

24 COMPOSITE MATERIALS

Includes laminates.

N79-10145 Pennsylvania Univ., Philadelphia.
A HIGH TEMPERATURE THERMODYNAMIC AND KINETIC INVESTIGATION OF PLATINUM-TANTALUM AND PLATINUM-NIOBIUM INTERMETALLIC COMPOUND LAYERS Ph.D. Thesis
Sai-Kwing Lau 1978 161 p
Avail: Univ. Microfilms Order No. 7816321

The thermodynamic properties of platinum-tantalum alloys containing 2 to 29 at. pct. tantalum were investigated over the temperature range 830 to 1030 C using an Emf technique with thoria-based solid electrolytes. The free energies of formation of TaPt3 and TaPt2 are about -55 and -47 Kcal/mole, respectively, at 1000 C. This confirms that these intermetallic compounds are highly stable. The reaction kinetics between platinum thin films and tantalum or niobium substrates were also investigated over the temperature range 650 - 1200 C. X-ray diffraction was used for the characterization of product layers and scanning electron microscopy for morphological studies. It is shown that the outer layers of reacted samples are porous, but the inner layers beneath the porous network are coherent with the substrates. A model involving the diffusion of tantalum and niobium atoms into the platinum grain boundaries was proposed to interpret the formation mechanism of the observed porous surface network. Dissert. Abstr.

N79-10146 Pennsylvania Univ., Philadelphia.
FIBER-POLYMER INTERACTIONS IN GRAPHITE FIBER/EPOXY COMPOSITES Ph.D. Thesis
Yoon Suk Ko 1978 194 p
Avail: Univ. Microfilms Order No. 7816319

Materials used for study were Hercules type AU, AS, HMU, and HMS fibers and metaphenylene diamine cured Epon 828 resin. Experiments consisted of: (1) a study of topology and chemical composition of fiber surfaces using scanning electron microscopy and electron spectroscopy; (2) dynamic mechanical characterization of unfilled epoxy polymers from 20 to 210 C for various amine/epoxy ratios and curing schedules; (3) measurement of changes in storage modulus and damping of composites exposed to steam; (4) evaluation of the interfacial adhesion of composites in air and immersed in boiling water by a short beam shear test; (5) dynamic mechanical tests of composites of various fiber contents and fiber types from 20 to 240 C; and (6) visual observation of composite cross-sections and the fracture surface by optical and scanning electron microscopy. Dissert. Abstr.

N79-10147*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
ON POISSON'S RATIO FOR METAL MATRIX COMPOSITE LAMINATES Interim Report
Carl T. Herakovich and Mark J. Shuart Sep. 1978 23 p refs
(Grant NGR-47-004-129)
(NASA-CR-157779; VPI-E-78-26; IR-3) Avail: NTIS HC A02/MF A01 CSCL 11F

The definition of Poisson's ratio for nonlinear behavior of metal matrix composite laminates is discussed and experimental results for tensile and compressive loading of five different boron-aluminum laminates are presented. It is shown that there may be considerable difference in the value of Poisson's ratio as defined by a total strain or an incremental strain definition. It is argued that the incremental definition is more appropriate for nonlinear material behavior. Results from a (0) laminate indicate that the incremental definition provides a precursor to failure which is not evident if the total strain definition is used. Author

N79-10148# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
IMPROVED EFFECTIVE MASS APPROXIMATION FOR IMPURITY LEVELS IN INSULATORS
Paulo S. Guimaraes, Nelson DeJesusParada, and Luiz G. Ferreira Jul. 1978 8 p refs
(INPE-1308-PE/151) Avail: NTIS HC A02/MF A01

A variational expression for the energy eigenvalues of an impurity in an insulating matrix is presented. The variational expression may yield better results than those of the effective mass approximation because the smoothly varying potential hypothesis is not needed. G.Y.

N79-10149*# Science Applications, Inc., Sunnyvale, Calif.
DEVELOPMENT OF FLAME RESISTANT TREATMENT FOR NOMEX FIBROUS STRUCTURES Annual Report
Madeline S. Toy 25 Aug. 1978 40 p
(Contract NAS9-14827)
(NASA-CR-151834; SAI-1-108-00-546) Avail: NTIS HC A03/MF A01 CSCL 11D

Technology which renders aramid fibrous structures flame resistant through chemical modification was developed. The project scaled up flame resistant treatment from laboratory fabric swatches of a few inches to efficiently producing ten yards of commercial width (41 inches) aromatic polyamide. The radiation intensity

problem of the processor was resolved. Further improvement of the processor cooling system was recommended for two reasons: (1) To advance current technology of flame proofing Nomex fabric to higher oxygen enriched atmospheres; and (2) To adapt the processor for direct applicability to low cost commercial fabrics. B.B.

N79-10150*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A TEMPERATURE DEPENDENT FATIGUE FAILURE CRITERION FOR GRAPHITE/EPOXY LAMINATES

Assa Rotem and Howard G. Nelson Oct. 1978 20 p refs Presented at the Symp. on New Dev. and Appl. in Composites, St. Louis, 15-19 Oct. 1978

(NASA-TM-78538; A-7656) Avail: NTIS HC A02/MF A01 CSCL 11D

A fatigue failure criterion applicable to composite materials is developed and applied to predict the fatigue behavior of graphite/epoxy laminates with particular emphasis on the influence of temperature. Tensile stress-strain curves and tension-tension fatigue curves for various unidirectional, angle-ply and symmetrically balanced laminates were developed at test temperatures of 25 C, 74 C, and 114 C. For most laminates a reduction in both static strength and fatigue strength is observed with increasing temperature. This reduction appeared more severe in fatigue loading than in static tensile loading and most severe where the shear stress in the lamina is the dominate failure mode. Through an analytical formulation of shifting functions for the influences of temperature, all fatigue data are shown to be capable of being reduced to a single reference curve at some temperature. Examples are given which demonstrate the capability of the fatigue failure criterion to predict failure of complex symmetrically balanced laminates from relevant parameters obtained from the observed behavior of unidirectional and angle-ply laminates. Author

N79-10151# Army Materials and Mechanics Research Center, Watertown, Mass.

PREDICTION OF THE TRANSVERSE STRENGTH OF GRAPHITE/ALUMINUM COMPOSITES Final Report

Dennis Riggs 18 Oct. 1978 18 p refs

(DA Proj. 1L1-62105-AH-84)

(AD-A056779; AMMRC-TR-78-19) Avail: NTIS HC A02/MF A01 CSCL 11/4

The theoretical transverse tensile strength of graphite/aluminum composites was calculated using an elastic analysis technique. It was found that the theoretical behavior of the composite is quite similar to that of a multi-holed flat plate loaded in the transverse direction. Large stress concentrations build up at the fiber-matrix interface resulting in failure at low levels of applied stress. The applied failure stress decreases markedly as the volume fraction of fibers increases. It was concluded that the transverse strength for a 35 volume percent graphite/aluminum composite would probably not exceed 10 ksi (unless interleaving was used, for example) mainly because the transverse properties of the reinforcing fibers are inherently poor and the fiber-matrix bond is very weak. Author (GRA)

N79-10152# Cambridge Univ. (England). Dept. of Engineering.

IMPROVING THE IMPACT AND FRACTURE RESISTANCE OF FIBROUS COMPOSITES Final Technical Report, 1 Feb. 1975 - 31 Jan. 1978

Peter W. R. Beaumont, John N. Kirk, and Michael Munro 1977 51 p refs

(Grant DA-ERO-75-G-009; DA Proj. 1T1-61102-b-35E)

(AD-A056602; CUED/C-MAT/TR.46-1977) Avail: NTIS HC A04/MF A01 CSCL 11/4

The report is the third in a trilogy on the fracture of fibrous composites prepared. It describes a study of the fracture mechanisms in fibrous composites. The report is divided into 2 sections; the first part describes the temperature and strain-rate effects on the crack initiation energy, and crack initiation energy and crack propagation energy of a carbon fibre-epoxy resin composite and a glass fibre-epoxy resin composite. The second part describes a study of the fracture mechanisms in a hybrid fibrous composite containing carbon and glass fibres. Author (GRA)

N79-10153# Army Materials and Mechanics Research Center, Watertown, Mass.

ENVIRONMENTAL EFFECTS ON THE MECHANICAL PROPERTIES OF GLASS FIBER/EPOXY RESIN COMPOSITES, EFFECT OF STATIC IMMERSION IN WATER ON THE TENSILE STRENGTH OF CROSSPLY LAMINATES

Byung Lip Lee, Robert W. Lewis, and Robert E. Sacher Jun. 1978 14 p refs

(AD-A056460) Avail: NTIS HC A02/MF A01 CSCL 11/2

The use of glass fiber-reinforced resin composites in primary structures for Army applications has been on the increase in recent years. They are being, or will be, employed in load-bearing areas in several rotor blade systems - the CH-47 modification, the Advanced Attack Helicopter, the Blackhawk, and the AH-1Q Cobra Improved Main Rotor Blade - as well as being used in critical areas in the VIPER system. Despite this projected usage, the questions on the stability of the material properties upon exposure to outdoor environments remain largely unanswered. The outdoor weathering conditions are extremely complex and include such factors as temperature, electromagnetic radiation (for example, sunlight), and moisture. These are considered to be the major elements responsible for the degradation of materials in the atmosphere. GRA

N79-10154# Oak Ridge National Lab., Tenn.

ASSESSMENT OF FIBROUS INSULATION ON MATERIALS FOR THE SELENIDE ISOTOPE GENERATOR

G. C. Wei and V. J. Tennery Nov. 1977 31 p

(Contract W-7405-eng-26)

(ORNL/TM-5908) Avail: NTIS HC A03/MF A01

Fibrous insulations for use in the converter and the heat source of the radioisotope powered, selenide element, thermoelectric generator (selenide isotope generator) were assessed. The most recent system design and material selection basis is presented. Several fibrous insulation materials which have the potential for use as load-bearing or non-load-bearing thermal insulations were reviewed. Some of the potential problems with the applications of fibrous insulations in the selenide isotope generator are as follows: (1) compatibility with graphite, (2) the thermoelectric elements, and the isolation hot frame; (3) devitrification, (4) grain growth, and (5) sintering with an accompanying degradation of insulation quality. Areas in which thermophysical data or quantitative information on the insulation and structure stability is lacking are identified. DOE

N79-10155# National Technical Information Service, Springfield, Va.

METAL MATRIX COMPOSITES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Jul. 1978

Mona F. Smith Jul. 1978 274 p Supersedes NTIS/PS-77/0612; NTIS/PS-76/0513; NTIS/PS-75/422; COM-74-10831

(NTIS/PS-78/0684/7; NTIS/PS-77/0612; NTIS/PS-76/0513; NTIS/PS-75/422; COM-74-10831) Avail: NTIS HC $28.00/MF $28.00 CSCL 11D

Fabrication, casting, mechanical properties, and testing of metal matrix composites including eutectic, particulate, and whisker composites are included in this report of federally-funded research. Studies on reinforcing materials, fatigue, and structure are also reported. Most of this research is applied to aircraft and spacecraft components and superconducting machinery. This updated bibliography contains 268 abstracts, 44 of which are new entries to the previous edition. GRA

N79-10156# General Atomic Co., San Diego, Calif. Medical Products Div.

STUDIES OF CARBON-SURFACED POLYMERIC, METALLIC, AND CERAMIC BIOMATERIALS Annual Report, 1 Apr. 1977 - 31 Mar. 1978

A. D. Haubold and H. S. Shim May 1978 69 p refs

(Contract N01-HV-4-2928)

(PB-282893/7; GA-A-14975; NIH-N01-HV-4-2928-2) Avail: NTIS HC A04/MF A01 CSCL 06B

Engineering studies were carried out which established the adhesion, strain-to-failure, wear, fatigue, and fluid friction erosion characteristics of test specimens coated with a thin layer of isotropic (LTI-like) carbon. These studies demonstrated that carbon-coated composites possess the necessary engineering

properties for use in prosthetic devices. The biological test results indicate that composites surfaced with thin isotropic carbon films exhibit biochemical properties similar to those of LTI carbon. About 950 implant rings were molded from five different polymers. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N79-10157 Engineering Sciences Data Unit, London (England).
VAPOR PRESSURES AND CRITICAL POINTS OF LIQUIDS. 12: AROMATIC NITROGEN COMPOUNDS
Mar. 1978 30 p
(ESDU-78011; ISBN-0-85679-212-8) For information on availability of series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $434.50

All quantities are expressed in SI units, in this case kN/sq m and kelvins, but for users who require them in mmHg and C some data are given in these units, and conversion factors to other units are provided. The procedures used to derive the values of vapor pressure are presented. The values of vapor pressure given in the tables were obtained by evaluating, for each compound, an equation in the form of a series of Chebyshev polynomials fitted to the data that were selected and weighted in accordance with a critical assessment of all the data. The accuracy and the uncertainties in the values presented are discussed. ESDU

N79-10158 Engineering Sciences Data Unit, London (England).
HEAT CAPACITY AND ENTHALPY OF LIQUIDS: ALKENES AND DIENES
May 1978 15 p
(ESDU-78015; ISBN-0-85679-216-0) For information on availability of series, sub-series, or individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $290.50

Quantities are expressed in SI units and conversion factors to other units are provided. The procedure used to obtain the values of heat capacity are described and indicates the effect of pressure. Values of enthalpy were derived from values of heat capacity. An explanation of the tables is given and the uncertainties in the values presented in them are indicated. All the sources of data used in the preparation of this item are also given. ESDU

N79-10159 California Univ., San Diego.
A NUCLEAR MAGNETIC RELAXATION STUDY OF LINEAR MOLECULES IN ISOTROPIC AND LIQUID CRYSTAL SOLVENTS Ph.D. Thesis
Nikolaus Manfred Szeverenyi 1978 112 p
Avail: Univ. Microfilms Order No. 7814994

The rotational reorientation of cyanoacetylene and dicyanoacetylene was studied as a function of hydrocarbon solvent viscosity at 24.5 C using nuclear magnetic relaxation techniques. The viscosity dependence of the correlation time is too gentle to be described by any current hydrodynamic model including that recently derived under slip boundary conditions. The rotational reorientation of cyanoacetylene in an anisotropic solvent was also examined. Spectral densities of the time correlation functions of various spherical harmonics in the quadrupolar relaxation Hamiltonian were measured. These spectral densities are sensitive to different molecular processes and it was shown that director fluctuations play a role in the reorientation of the solute molecule. An experiment to determine spectral densities of motion through the relaxation rate of a double quantum coherence is presented. Dissert. Abstr.

N79-10160 Lehigh Univ., Bethlehem, Pa.
MATHEMATICAL MODELING OF HYDRODYNAMIC CHROMATOGRAPHY (HDC) Ph.D. Thesis
Cesar Augusto Silebi 1978 200 p
Avail: Univ. Microfilms Order No. 7815830

Hydrodynamic chromatography (HDC) is a method developed for particle size measurement of colloidal latexes in the submicron range. This research is presented in two main parts: in the first part, a mathematical model is developed from first principles to elucidate the main features of the HDC separation process. The second part deals with a quantitative evaluation of the detection methods that can be used in HDC, and an analysis of experimental chromatograms of various samples with known particle size distributions using numerical as well as analytical techniques to generate particle size distributions directly from the output signal of the injected sample. Dissert. Abstr.

N79-10161 State Univ. of New York at Buffalo.
SOLID-SOLID REACTIONS PROCEEDING THROUGH GASEOUS INTERMEDIATES; REDUCTION OF WUSTITE WITH GRAPHITE IN CARBON MONOXIDE-CARBON DIOXIDE GAS MIXTURE Ph.D. Thesis
Cihan Karatas 1978 159 p
Avail: Univ. Microfilms Order No. 7817048

Experimental measurements are reported on the reaction between solid wustite and solid graphite particles, compressed in a pellet, in an environment of carbon monoxide, carbon dioxide at temperatures 800-1050 C. The variables included the pellet thickness, the temperature, the composition of the bulk gas to which the pellets were exposed, and carbon reactivity. An attempt was made to interpret the results by using the mathematical model developed in conjunction with the kinetic parameters that were determined independently for the reaction systems: $FeO(s) + CO(g) = Fe(s) + CO(g)$ and $C(s) + CO2(g) = 2CO(g)$. Dissert. Abstr.

N79-10162* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PROCESS FOR THE PREPARATION OF CALCIUM SUPEROXIDE Patent
E. Vernon Ballou (San Jose State Univ., Calif.), Peter C. Wood (San Jose State Univ., Calif.), Theodore J. Wydeven, and Leroy A. Spitze, inventors (to NASA) (San Jose State Univ., Calif.) Issued 18 Jul. 1978 13 p Filed 11 Jul. 1977 Supersedes N77-29252 (15 - 20, p 2645)
(NASA-Case-ARC-11053-1; US-Patent-4,101,644; US-Patent-Appl-SN-814378; US-Patent-Class-423-581; US-Patent-Class-23-252R) Avail: US Patent Office CSCL 07D

Calcium superoxide is prepared in high yields by spreading a quantity of calcium peroxide diperoxyhydrate on the surface of a container, positioning said container in a vacuum chamber on a support structure through which a coolant fluid can be circulated, partially evacuating said vacuum chamber, allowing the temperature of the diperoxyhydrate to reach the range of about 0 to about 40 C; maintaining the temperature selected for a period of time sufficient to complete the disproproriation of the diperoxyhydrate to calcium superoxide, calcium hydroxide, oxygen, and water; constantly and systematically removing the water as it is formed by sweeping the reacting material with a current of dry inert gas and/or by condensation of said water on a cold surface; backfilling the chamber with a dry inert gas; and finally, recovering the calcium superoxide produced. Official Gazette of the U.S. Patent Office

N79-10163* National Aeronautics and Space Administration. Pasadena Office, Calif.
PORTABLE ELECTROPHORESIS APPARATUS USING MINIMUM ELECTROLYTE Patent
Mario R. Stevens (JPL) and John Michael Vickers, inventors (to NASA) (JPL) Issued 13 Jan. 1976 5 p Filed 15 Oct. 1973 Sponsored by NASA
(NASA-Case-NPO-13274-1; US-Patent-3,932,262; US-Patent-Appl-SN-406296; US-Patent-Class-204-299; US-Patent-Class-204-180S) Avail: US Patent Office CSCL 07D

An electrophoresis unit for use in conducting electrophoretic analysis of specimens is described. The unit includes a sealable container in which a substrate mounted specimen is suspended in an electrolytic vapor. A heating unit is employed to heat a supply of electrolyte to produce the vapor. The substrate is

suspended within the container by being attached between a pair of clips which also serve as electrodes to which a direct current power source may be connected.
Official Gazette of the U.S. Patent Office

N79-10164 Temple Univ., Philadelphia, Pa.
ELECTRIC DOUBLE-LAYER STUDY BY PHASE SELECTIVE ac POLAROGRAPHY Ph.D. Thesis
Wayne I. Miles 1978 226 p
Avail: Univ. Microfilms Order No. 7817330

A relatively new technique is described to automatically record the differential capacitance-potential relation of liquid and solid electrode-solution interfaces. The experimental differential capacitance versus potential curves are used to determine the nature of the adsorption isotherm and its parameters for the adsorption of sodium p-toluene sulphonate on Hg and a disc-glassy carbon electrode. The nature of the adsorption isotherm provides valuable information about the electrical and structural aspects of the electrical double-layer. Such information is necessary in all electrochemical studies regardless of whether mass or charge transfer processes, kinetics of electrode processes or use of electroanalytical techniques solely for analytical purposes are being studied. Dissert. Abstr.

N79-10165*# General Applied Science Labs., Inc., Westbury, N. Y.
EMISSION MEASUREMENTS FOR A LEAN PREMIXED PROPANE/AIR SYSTEM AT PRESSURES UP TO 30 ATMOSPHERES Final Report
Gerald Roffe and K. S. Venkataramani Jun. 1978 41 p ref
(Contract NAS3-20603)
(NASA-CR-159421; GASL-TR-250) Avail: NTIS HC A03/MF A01 CSCL 21B

The emissions of a lean premixed system of propane/air were measured in a flametube apparatus. Tests were conducted at inlet temperatures of 600K and 800K and pressures of 10 atm and 30 atm over a range of equivalence ratios. The data obtained were combined with previous data taken in the same apparatus to correlate nitrogen oxide emissions with operating conditions. Sampling probe design was found to have a pronounced effect on measured CO levels but did not influence measurements. The most effective probe tested was one which combined thermal and pressure quenching of the gas sample. A.R.H.

N79-10166*# National Aeronautics and Space Administration, Washington, D. C.
CHEMICAL PROPERTIES AND METHODS OF ANALYSIS OF REFRACTORY COMPOUNDS
G. V. Samsonov, ed., I. N. Frantsevich, ed., V. N. Yeremenko, ed., T. N. Nazarchuk, ed., and O. I. Popova, ed. Oct. 1978 201 p refs Transl. into ENGLISH of the book "Khimicheskiye Svoystua i Metody Analiza Tugoplavkikh Soyedineniy" Kiev, Naukova Dumka Press, 1969 p 1-164 Original language document was announced as A70-12977 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75335) Avail: NTIS HC A10/MF A01 CSCL 07D

Reactions involving refractory metals and the alloys based on them are discussed. Chemical, electrochemical, photometric, spectrophotometric, and X-ray analysis are among the methods described for analyzing the results of the reactions and for determining the chemical properties of these materials. A.R.H.

N79-10167*# National Aeronautics and Space Administration. Pasadena Office, Calif.
OZONATION OF COOLING TOWER WATERS Patent Application
Marshall F. Humphrey (JPL), Kenneth R. French (JPL), and Ronald D. Howe, inventors (to NASA) (JPL) Filed 29 Sep. 1978 10 p
(Contract NAS7-100)
(NASA-Case-NPO-14340-1; US-Patent-Appl-SN-946992) Avail: NTIS HC A02/MF A01 CSCL 07D

This invention relates to inhibition of corrosion and algae in heat exchange water streams. The previously used chromium additives did little to prevent biological growth and though effective and inexpensive in protecting metals from corrosion, its use was restricted due to environmental problems. Ozone was utilized at low levels in conjunction with other additives to control bacteria and microorganisms. NASA

N79-10168*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A PROCESS FOR CONVERTING AMORPHOUS TO CRYSTALLINE SILICON WITH ATTENDANT PURIFICATION Patent Application
William M. Ingle (Motorola Inc., Phoenix, Ariz.) and Gilbert Vasquez, inventors (to NASA) (Motorola Inc., Phoenix, Ariz.) Filed 31 Aug. 1978 12 p
(Contract JPL-954442)
(NASA-Case-NPO-14223-1; US-Patent-Appl-SN-938580) Avail: NTIS HC A02/MF A01 CSCL 07D

The invention relates to a process for converting amorphous to crystalline silicon with attendant purification. The invention is embodied in a process wherein amorphous silicon is heated to a temperature above approximately 730 deg. in vacuo for initiating exothermic conversion of the amorphous silicon to silicon in its dendritic form, accompanied by an instantaneous expulsion of impurities whereby the purity of the resultant silicon is enhanced. NASA

N79-10169*# National Aeronautics and Space Administration. Pasadena Office, Calif.
STARK CELL OPTOACOUSTIC DETECTION OF CONSTITUENT GASES IN SAMPLE Patent Application
Jack S. Margolis (JPL) and Michael S. Shumate, inventors (to NASA) (JPL) Filed 31 Aug. 1978 14 p
(Contract NAS7-100)
(NASA-Case-NPO-14143-1; NASA-Case-NPO-14342-1; US-Patent-Appl-SN-938297) Avail: NTIS HC A02/MF A01 CSCL 07D

The invention relates to an improved optoacoustic detector and a method of using such an improved detector with a multiline laser for determining the combination of constituent gases in a sample, and determining the concentration of parts per million of each concentration. NASA

N79-10170# Akron Univ., Ohio. Inst. of Polymer Science.
CHEMISTRY OF SILANE COUPLING REACTIONS. 1: REACTION OF TRIMETHYLMETHOXYSILANE AND TRIETHYLSILANOL STUDIED BY GLC
P. Dreyfuss 11 Jul. 1978 39 p refs
(Contract N00014-76-C-0408; NR proj. 092-055)
(AD-A056781; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/4

The conditions under which reaction will occur and the products of reaction between trimethylmethoxysilane and a model for a glass surface, triethylsilanol, were studied by gas liquid chromatography. Reaction occurred faster and under milder conditions than anticipated. Immediately after mixing at room temperature, methanol and the unsymmetrical disiloxane, 1,1,1-triethyl-3,3,3-trimethyldisiloxane, were formed; water formed soon thereafter. Simultaneously, the concentration of trimethylmethoxysilane decreased dramatically and the concentration of triethylsilanol decreased to a degree comparable to the amount of unsymmetrical disiloxane formed. The symmetrical disiloxanes were also present and their concentrations were monitored. After about two hours an apparent equilibrium was attained with the unsymmetrical disiloxane as about 60% of the product, but at very long times, 5-10 days, the reaction mixture contained more than 90% 1,1,1-triethyl-3,3,3-trimethyldisiloxane. These reactions occurred readily either near or in acetone, benzene, benzene-octane, or octane as solvent.
Author (GRA)

N79-10171# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
ENERGETIC TRANSIENT SPECIES FORMED VIA ELECTRONIC EXCITATION OF S-TNB AND S-TNT
Christos Capellos and Sury Iyer Jun. 1978 15 p refs
(AD-A056417) Avail: NTIS HC A02/MF A01 CSCL 19/1

In the present paper, data are presented on the spectroscopy and chemical reactivity of ionic species, electronically excited states, and free radicals of nitro aromatics formed via electronic excitation of the parent molecules. Furthermore, it was discovered in the present work, that formation of the TNT anion, (C_6H_2)

(NO2)3 CH2, (B-), in molten TNT by additives such as (CH3) 4NB3H8, known as QMB3, NAOH, and NaI lead to deflagration of TNT. These additives sensitized TNT to impact, and differential scanning calorimetry yielded data which are consistent with the sensitization of TNT by these additives. GRA

N79-10172# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.
CHEMISORPTION ON PERFECT SURFACES AND STRUCTURAL DEFECTS Ph.D. Thesis
Ruichen Liu Oct. 1977 346 p refs
(Contract DAAB07-72-C-0259; NSF DMR-76-82088)
(AD-A056535; R-790; UILU-eng-77-2237) Avail: NTIS HC A15/MF A01 CSCL 07/4

Chemisorption of nitrogen and hydrogen on densely packed planes of tungsten, molybdenum, iridium, and rhenium has been studied by probe-hole field emission microscopy. Adsorption on perfect planes, as well as on planes containing structural defects, has been investigated. The results can be interpreted by the promotion of chemisorption at structural defects on smooth surfaces. A model, which can account for the results as well as observations on macroscopic surfaces, is presented.
Author (GRA)

N79-10173# Texas A&M Research Foundation, College Station.
COMPILATION OF SPECTROSCOPIC DATA FOR TRACE ATMOSPHERIC GASES Final Report, 1 Apr. 1977 - 31 Mar. 1978
L. D. G. Young 30 May 1978 34 p refs
(Grant AF-AFOSR-3270-77)
(AD-A056891; AFOSR-78-1190TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

This report contains a fit to the inversion spectrum of ammonia; data on HNO3 in the infrared and microwave regions; data for the 1-0, 2-0 and 3-0 bands of NO. Author (GRA)

N79-10174# Washington State Univ., Pullman. Dept. of Chemistry.
CHEMICAL MEASUREMENTS IN THE PICOSECOND AND SHORTER TIME RANGE Interim Technical Report
Stephen C. Pyke Mar. 1978 129 p
(Contract N00014-75-C-0535; Grant DAAG29-76-G-0275)
(AD-A057081; TR-13-ONR) Avail: NTIS HC A07/MF A01 CSCL 07/4

Instrumentation and techniques for chemical measurements in the picosecond and shorter time range are reviewed and described in detail. Representative applications in photochemistry and photobiology are given. Author (GRA)

N79-10175# Brookhaven National Lab., Upton, N. Y.
HYDROGEN ISOTOPE EXCHANGE IN METAL HYDRIDE COLUMNS
R. Wiswall, J. Reilly, F. Bloch, and E. Wirsing 21 Nov. 1977 34 p refs
(Contract EY-76-C-02-0016)
(BNL-50755) Avail: NTIS HC A03/MF A01

Several metal hydrides were shown to act as chromatographic media for hydrogen isotopes. The procedure was to equilibrate a column of hydride with flowing hydrogen, inject a small quantity of tritium tracer, and observe its elution behavior. Characteristic retention times were found. From these and the extent of widening of the tritium band, the heights equivalent to a theoretical plate could be calculated. Values of around 1 cm were obtained. The following are the metals whose hydrides were studied, together with the temperature ranges in which chromatographic behavior was observed: vanadium, 0 to 70 C; zirconium, 500 to 600 C; LaNi5, -78 to +30 C; Mg2Ni, 300 to 375 C; palladium, 0 to 70 C. A dual-temperature isotope separation process based on hydride chromatography was demonstrated. DOE

N79-10176# Argonne National Lab., Ill.
RECENT ADVANCES IN SQUID NMR TECHNIQUES
R. A. Webb 1978 11 p refs Presented at Conf. on Future Trends in Superconductive Electronics, Charlottesville, Va., 23 Mar. 1978
(Contract W-31-109-eng-38)
(CONF-780339-3) Avail: NTIS HC A02/MF A01

A discussion of the techniques used for performing a variety of magnetic resonance experiments using a SQUID is presented. In particular, measurements of the nuclear magnetism of liquid He-3 in the temperature range 1.2 K to 2 mK in magnetic fields of 3.7 to 309 Oe using pulsed NMR, c-w NMR, adiabatic fast passage, and static susceptibility using the same detection system are discussed. DOE

N79-10177# Ames Lab., Iowa.
LOW TEMPERATURE HEAT CAPACITY OF LUTETIUM AND LUTETIUM HYDROGEN ALLOYS M.S. Thesis
D. K. Thome Oct. 1977 70 p refs
(Contract W-7405-eng-82)
(IS-T-769) Avail: NTIS HC A04/MF A01

The heat capacity of high purity electrotransport refined lutetium was measured between 1 and 20 K. Results for theta/sub D/ were in excellent agreement with theta values determined from elastic constant measurements. The heat capacity of a series of lutetium-hydrogen solid solution alloys was determined and results showed an increase in gamma from 8.2 to about 11.3 mJ/g-atom-sq. K for hydrogen content increasing from zero to about one atomic percent. Above one percent hydrogen gamma decreased with increasing hydrogen contents. The C/T data showed an increase with temperature decreasing below about 2.5 K for samples with 0.1 to 1.5 atomic percent hydrogen. This accounts for a large amount of scatter in theta/sub D/ versus hydrogen content in this range. The heat capacity of a bulk sample of lutetium dihydride was measured between 1 and 20 K and showed a large increase in theta/sub D/ and a large decrease in gamma compared to pure lutetium. DOE

N79-10178# Chicago Univ., Ill.
COAL ANION STRUCTURE AND CHEMISTRY OF COAL ALKYLATION Quarterly Progress, 1 Jun. - 31 Aug. 1977
L. M. Stock 1977 6 p
(Contract EF-77-S-02-4227)
(COO-4227-2; QPR-2) Avail: NTIS HC A02/MF A01

Work is in progress concerning the proton and carbon nuclear magnetic resonance spectra of butylated coal samples. The synthesis of perdeuteriotetralin was completed. The control experiments using tetralin as a reagent for the conversion of Illinois 6 in tetralin were completed. DOE

N79-10179# Battelle Pacific Northwest Labs., Richland, Wash.
CHEMICAL PRODUCTION FROM WASTE CARBON MONOXIDE: ITS POTENTIAL FOR ENERGY CONSERVATION
C. A. Rohrmann, G. F. Schiefelbein, P. M. Molton, C. T. Li, D. C. Elliott, and E. G. Baker Nov. 1977 289 p
(Contract EY-76-C-06-1830)
(BNWL-2137) Avail: NTIS HC A13/MF A01

Results of a study of the potential for energy conservation by producing chemicals from by-product or waste carbon monoxide(CO) from industrial sources are summarized. Extensive compilations of both industrial sources and uses for carbon monoxide were developed and included. Reviews of carbon monoxide purification and concentration technology and preliminary economic evaluations of carbon monoxide concentration, pipeline transportation and utilization of CO in the synthesis of ammonia and methanol are included. Preliminary technical and economic feasibility studies were made of producing ammonia and methanol from the by-product CO produced by a typical elemental phosphorus plant. Methanol synthesis appeared to be more attractive than ammonia synthesis when using CO feedstock because of reduced water gas shift and carbon dioxide removal requirements. DOE

N79-10180# National Technical Information Service, Springfield, Va.
CHEMICAL VAPOR DEPOSITION, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Jul. 1978
Mona F. Smith Jul. 1978 219 p Supersedes NTIS/PS-77/0613; NTIS/PS-76/0522; NTIS/PS-75/477
(NTIS/PS-78/0691/2; NTIS/PS-77/0613; NTIS/PS-76/0522; NTIS/PS-75/477) Avail: NTIS HC $28.00/MF $28.00 CSCL 11C

Research reports on chemical vapor deposition of carbon, carbides, ceramics, metals, and glasses are cited. Applications

of this process include optical coatings, semiconducting films, laser materials, solar cells, composite fabrication, and nuclear reactor material fabrication. The physical, mechanical, and chemical properties of these coatings are covered. This updated bibliography contains 213 abstracts, 65 of which are new entries to the previous edition. GRA

N79-10181# Underwriters Labs., Inc., Northbrook, Ill.
DEVELOPMENT AND VERIFICATION OF FIRE TESTS FOR CABLE SYSTEMS AND SYSTEM COMPONENTS Quarterly Report, 1 Sep. 1977 - 28 Feb. 1978
L. Przybyla and W. J. Christian Jun. 1978 45 p
(Contract NRC-04-77-122)
(PB-283382/0; UL-USNC-75Q2-3; NUREG-CR-0152; QR-2; QR-3) Avail: NTIS HC A03/MF A01 CSCL 09A

Vertical flame tests of tray-mounted cables are evaluated. The cables used in these experiments were stranded seven (copper) conductor, No. 12 AWG with PVC conductor insulation, nylon conductor jacket, and PVC cable jacket. Parameters considered were fuel input rate, fuel-air ratio, burner location, and test cell configuration. Full cable trays, 8 ft long, were used in these experiments, and observations were made of the flame travel distances and air temperatures on both faces of the tray, as well as temperature distribution along the jacket of one cable in each tray. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N79-10182 Rochester Univ., N. Y.
STUDY OF RESISTANCE ANOMALIES IN THE ORDER-DISORDER ALLOY SYSTEM Fe-Al Ph.D. Thesis
Dev Prasad Chakraborty 1978 90 p
Avail: Univ. Microfilms Order No. 7815266

Resistivity of the binary alloy system Fe-Al is presented over wide temperature intervals encompassing the Fe3Al-FeAl order-disorder transitions. This system is an Ising model archetype where the wide disparity of the Fe and Al pseudo-potentials produces large critical scattering anomalies in the resistivity. The data close to the transition temperature (T sub c) is interpreted to reflect the energy-like dependence of the asymptotic high momentum correlation function. No evidence was found to support the view expressed in a prior investigation of this system that below T sub c there is a direct coupling of the resistivity to the order parameter. The high temperature data has a rather unique form which is interpreted in terms of the classical Ornstein-Zernike correlation function. This analysis rests on a unified view of resistive anomalies near ferromagnetic and antiferromagnetic phase transitions, which is not transparent in existing theories. Dissert. Abstr.

N79-10183 Pittsburgh Univ., Pa.
PERMANENT MAGNET PROPERTIES OF SOME 1:5 AND 2:17 SUBSTITUTED LANTHANOID-COBALT INTERMETALLICS Ph.D. Thesis
Mircea Orest Merches 1978 259 p
Avail: Univ. Microfilms Order No. 7817273

The effect of alloying on the various magnetic and structural properties of substituted lanthanoid-cobalt intermetallics was studied. Crystal field interaction theory was used as a guide for the substitutions in the lanthanoid sublattice. Evidence was acquired which emphasized the specificity of different substituents. In the LnCo5 materials the relative positive contribution of cobalt in the 2(c) sites compared to cobalt in the 3(g) sites was indicated by the decrease in the anisotropy at small nickel substitution. Also, the negative dumbbell contribution was demonstrated by the increase in the anisotropy for larger substituted atoms (iron and manganese) which expand the lattice. Systems were found in which improvement of one of the permanent magnet properties did not drastically deteriorate the other. Dissert. Abstr.

N79-10184*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ARC TERMINATION CRACKS IN INCONEL 718 AND INCOLOY 903
E. Bayless, J. McCaig, and R. Poorman Oct. 1978 17 p
(NASA-TM-78201) Avail: NTIS HC A02/MF A01 CSCL 11F

The welding of the nickel base, heat resistant alloys that are used extensively for welded Shuttle engine components revealed solidification cracking characteristics at weld termination points. If not detected and removed, these crater cracks may cause costly component failure. To better understand this characteristic, welding termination techniques were studied and methods developed to eliminate crater cracks. It was determined that weld termination solidification cracking can be eliminated by controlled decrease of welding current, welding voltage, wire feed, and travel speed. A.R.H.

N79-10185# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
VARIATIONAL METHOD FOR MAGNETIC IMPURITIES IN METALS. 2: ORBITAL DEGENERACY
Koung-An Chao, A. M. Oles (Jagellonian Univ., Cracow, Poland), and J. Spalek (Imperial Coll., London) Jul. 1978 18 p refs
(INPE-1307-PE/150) Avail: NTIS HC A02/MF A01

The previously developed variational method for the nondegenerate Wolff model is extended to include the orbital degeneracy in order to study the Hund's rule effect. New features are obtained and the results are compared to the Hartree-Fock solutions. Author

N79-10186# Watervliet Arsenal, N.Y. Benet Weapons Lab.
PHYSICAL AND MECHANICAL RELATIONSHIPS IN ELECTRO SLAG (ESR) STEEL
Vito J. Collangelo and Gary P. Lessen Jun. 1978 14 p refs
(AD-A056422) Avail: NTIS HC A02/MF A01 CSCL 11/6

Electroslag remelting of gun steel has been proposed as an alternate manufacturing process because of reported improvements in mechanical properties and potential economic benefits. These improvements are a result of the effective control of the many variables inherent in the process. In order to obtain a uniform microstructure while avoiding piping, porosity and macrosegregation, a unidirectional solidification mode is desired(1). This mode of solidification, together with the relatively short holding times of the molten metal, also affects the distribution of second phase particles; for example, it results in a more uniform carbide distribution because the carbides are not allowed to grow in the transverse or longitudinal directions. GRA

N79-10187# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
ELECTRONIC STRUCTURE OF METAL AND ALLOY SURFACES Interim Report
K. H. Johnson, C. Y. Yang, D. Vvedensky, R. P. Messmer (G. E. Co., Schenectady, N. Y.), and D. R. Alahub (Montreal Univ., Can.) 14 Jul. 1978 24 p refs Presented at the ASM Mater. Sci. Seminar on Interfacial Segregation, Chicago, 1977
(Contract N00014-75-C-0970; Grants NSF DMR-74-15224; NSF DMR-72-03027)
(AD-A056689) Avail: NTIS HC A02/MF A01 CSCL 11/6

The electronic structure of metal and alloy surfaces is central to the understanding of the physical and chemical properties of such surfaces. However, progress in calculating surface electronic structure from first principles has lagged behind that of calculating bulk band structure because of the difficulty of applying the conventional band description at an interface. The theoretical study of the electronic structure of finite metallic and bimetallic clusters representing local surface and bulk atomic configurations, including small particles, has the advantage that it can bridge the gap between solid-state band theory and molecular quantum chemistry, thereby permitting the elucidation of surface electronic structure as a function of local atomic arrangement and composition. GRA

N79-10188# Naval Postgraduate School, Monterey, Calif.
EFFECTS OF HYDRODYNAMIC VARIABLES ON CORROSION: STUDY OF 90/10 Cu-Ni IN A CIRCLING FOIL WITH SYNTHETIC SEAWATER M.S. Thesis
Gerhard Hannes Leumer Mar. 1978 144 p refs
(AD-A056381) Avail: NTIS HC A07/MF A01 CSCL 11/6

The effects of hydrodynamic variables and fluid properties

on corrosion of 90/10 Cu-Ni (CDA 706) in single metal exposures and in galvanic couples with platinum were studied in synthetic seawater. An apparatus utilizing circling foil as the specimen holder was redesigned as an experimental apparatus for this study. Various methods were applied to develop corrosion rate data for different flow situations. Particular emphasis was placed on the determination of variable parameters of fluid dynamics, and on the correlation of nondimensional hydrodynamic and mass transfer parameters with experimentally determined corrosion rates. Also, the corrosion morphology was studied macroscopically and microscopically for different velocities. A consideration of theoretical and practical factors concerning mass transfer and corrosion in a flowing medium concluded this study. Author (GRA)

N79-10189# Aluminum Co. of America, Alcoa Center, Pa. Alcoa Labs.

EFFECT OF MICROSTRUCTURE ON FATIGUE CRACK GROWTH OF 7XXX ALUMINUM ALLOYS UNDER CONSTANT AMPLITUDE AND SPECTRUM LOADING Final Report

T. H. Sanders, Jr., R. R. Sawtell, J. T. Staley, R. J. Bucci, and A. B. Thakker 14 Apr. 1978 259 p refs

(Contract N00019-76-C-0482)

(AD-A057129; Rept-56-78-AF8) Avail: NTIS HC A12/MF A01 CSCL 11/6

An investigation was made to identify microstructural features which control the fatigue crack growth characteristics of 7XXX aluminum alloys. Constant amplitude and simple overload tests were conducted in humid air on controlled microstructural variations of alloys 7075 and 7050. Results indicated that relative features and ranking of the alloys based on fatigue crack propagation resistance depend on loading conditions. GRA

N79-10190# Los Alamos Scientific Lab., N. Mex.

SOME MICROSTRUCTURES DEVELOPED IN 303 STAINLESS STEEL WHICH HAS BEEN SHOCK LOADED TO THE MEGABAR RANGE

D. J. Sandstrom and T. I. Jones 1977 14 p refs Presented at Workshop on Rapid Solidification, La Jolla, Calif., 11 Jul. 1977

(Contract W-7405-eng-36)

(LA-UR-77-1875; Conf-770738-1) Avail: NTIS HC A02/MF A01

A solid sphere of 303 stainless steel was subjected to a multimegabar shock pressure in a spherically convergent high explosive system. The recovered stainless steel wall was subjected to a metallurgical examination to determine the microstructural features developed in the ball. The cooling rate determinations were made by observing the dendrite arm spacing developed in the solidified metal. Inconsequential results regarding the cooling rate were obtained. Estimates of dendrite arm spacing were made and a solidification rate was estimated. The alloy used in this experiment, 303 stainless steel, is chemically too complex to develop easily interpreted results. DOE

N79-10191# Hanford Engineering Development Lab., Richland, Wash.

FRACTURE SURFACE MICROMORPHOLOGY OF INCONEL X-750 AT ROOM TEMPERATURE AND ELEVATED TEMPERATURES

W. J. Mills Sep. 1977 24 p refs

(Contract EY-76-C-14-2170)

(HEDL-TME-77-64) Avail: NTIS HC A02/MF A01

The fracture surface micromorphology of Inconel X-750 was examined in order to relate operative fracture mechanisms to key microstructural features. Under room temperature and intermediate temperature (approximately 600 F) conditions, failure occurred primarily by an intergranular dimple rupture mechanism associated with microvoid coalescence along a grain boundary denuded region. At progressively higher temperatures an intergranular to transgranular fracture mechanism transition was detected. In the 1000 to 1300 F regime, the Inconel X-750 fracture surfaces were dominated by a faceted transgranular morphology. This faceted appearance was attributed to extensive heterogeneous planar slip, characteristic of many nickel-base superalloys. DOE

N79-10192# California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Mechanical Engineering.

FRICTION AND WEAR STUDY OF DISPERSED PHASE INTERMETALLIC COMPOUNDS IN FERROUS MATRICES M.S. Thesis

R. A. Riddle Dec. 1977 76 p refs

(Contract W-7405-eng-48)

(LBL-5771) Avail: NTIS HC A05/MF A01

The development of materials with improved wear resistance, and the implementation of current wear-reducing technology in design procedures, are discussed. The basic wear process is defined as the degradation and removal of material surface, and is explained in terms of adhesion, abrasion, fracture and delamination, and corrosion. The interaction of wear mechanisms, and design strategies for reducing wear, stress the importance of understanding the effect of the environmental and loading conditions on the material removal process. Using powder metallurgy fabrication processes, wear test samples consisting of a ferrous binder and an intermetallic dispersed phase were made. The results of the wear tests led to the conceptual design of an improved wear test apparatus, and demonstrated the effectiveness of the intermetallic compounds as a dispersed phase in reducing wear rates. DOE

N79-10193# Brookhaven National Lab., Upton, N. Y.

DETECTING SUSCEPTIBILITY TO INTERGRANULAR CORROSION OF STAINLESS STEEL WELD HEAT AFFECTED ZONES

B. Vyas and H. S. Isaacs 1977 28 p refs Presented at Symp. on Fatigue Testing of Weldments, Toronto, May 1977

(Contract EY-76-C-02-0016)

(BNL-NUREG-22603; Conf-770524-2) Avail: NTIS HC A03/MF A01

A scanning reference electrode technique (SRET) was developed to study intergranular corrosion of austenitic stainless steels. The potential variations produced in the electrolyte due to the intergranular corrosion of the sensitized grain boundaries were measured by scanning a microtip reference electrode across a weld and heat affected zones. The development of a test based on the SRET for determining the degree of sensitization of stainless steels was explored. The technique is particularly useful in determining the degree of sensitization and the location of the sensitized grain boundaries adjacent to welds. The effect of material and welding variables on the location and degree of sensitization was studied. The results were compared with those from conventional tests for detecting susceptibility to intergranular corrosion. DOE

N79-10194# United Technologies Corp., South Windsor, Conn. Power Systems Div.

PARAMETER MONITORING FOR CORROSION CONTROL OF UTILITY GAS TURBINES Interim Report

F. Boenig Mar. 1978 128 p refs Sponsored by EPRI

(EPRI-AF-665) Avail: NTIS HC A07/MF A01

Field data on 600 engines was statistically analyzed to determine the influence on hot corrosion of fuel type, engine washing, air filtration, and the proximity of the engine sites to oceans. Laboratory tests conducted on turbine materials, with and without protective coatings, to assess relative resistance to corrosion were discussed, and corrosion rates in the presence of sodium sulfate alone and with carbon, vanadium and lead were defined. Atmospheric and fuel salt concentrations as well as sodium ion concentrations in the air stream inside engines were monitored for evidence of impulsive shedding of accumulated salt. An engine control system which will monitor the atmospheric and fuel-borne salt concentrations and signal the need for an engine water wash cycle to remove accumulated salt before corrosion has started was described. Results show that water washing reduces the incidence of corrosion and that turbine materials can tolerate alkali sulfates for a limited period before hot corrosion commences. DOE

N79-10195# Oak Ridge National Lab., Tenn. Engineering Technology Div.

THERMAL RATCHETTING TEST OF 2 1/4 Cr-1Mo STEEL TO TYPE 316 STAINLESS STEEL PIPE: TEST TTT-3

W. K. Sartory, H. C. Young, R. L. Battiste, and J. E. Smith 19 Sep. 1977 110 p refs

(Contract W-7405-eng-26)
(ORNL-5330) Avail: NTIS HC A06/MF A01

An experimental study of ratchetting in a structural component is described, and the results are used to evaluate inelastic analysis predictions of the ratchetting behavior. The specimen used in the test is a pipe consisting of three sections: a thick walled section of 2 1/4 Cr-1 Mo steel, a thin walled section of 2 1/4 Cr-1 Mo steel, and a thin walled section of type 316 stainless steel. In a special sodium test facility, the specimen was subjected to a series of thermal downshocks followed by sustained periods of high temperature operation under internal pressure. The inelastic analysis predictions, which were obtained by using a one dimensional finite element procedure for each of the three sections of the specimen, were based on constitutive equations developed for the specific heats of material used in the specimen. DOE

N79-10196# Sandia Labs., Livermore, Calif.
MECHANICAL PROPERTIES OF SULFAMATE NICKEL ELECTRODEPOSITS
H. R. Johnson, J. W. Dini, and R. E. Stoltz Mar. 1978 25 p refs Presented at 65th Conf. of Am. Electroplaters Soc., Washington, D. C., Jun. 1978
(Contract EY-76-C-04-0789)
(SAND-77-8042; Conf-780602-1) Avail: NTIS HC A02/MF A01

The influence of thickness on the mechanical properties of nickel electrodeposits at room and at elevated temperatures is examined. Deposits less than 0.07 mm thick exhibit higher ultimate tensile strengths, similar values for reduction in area, and lower elongation than do thicker deposits. Varying the strain rate 3000-fold at room temperature results in a gradual increase in tensile strength but no change in ductility. A noticeable reduction in ductility occurs above 400 C, particularly at normal laboratory strain rates. This reduction in ductility is accomplished by extensive intergranular cavity formation and fracture. Grain boundary fracture can be enhanced by sulfur, and codeposition of manganese is suggested as one means of overcoming the problem. At high strain rates no ductility losses are encountered. Heating the specimens for 24 hours at test temperature before testing, results in only minor changes in the properties as compared with those of unheated deposits. DOE

N79-10197# Battelle Columbus Labs., Ohio.
ECONOMIC EFFECTS OF METALLIC CORROSION IN THE UNITED STATES. APPENDIX C: BATTELLE COLUMBUS LABORATORIES INPUT/OUTPUT TABLES Final Report
J. H. Payer, D. G. Dippold, W. K. Boyd, W. E. Berry, E. W. Brooman, A. R. Buhr, and W. H. Fisher May 1978 751 p 3 Vol.
(Contract NBS-7-35716)
(PB-279430/3; NBS-GCR-78-122-App-C) Avail: NTIS HC A99/MF A01; also available in set of 3 reports HC E15, PB-282630-SET CSCL 11F

These tables consist of numerical data in matrix form without text. Direct technical coefficients worlds 1, 2, and 3, direct and indirect effects 1, direct and indirect effects 2, and direct and indirect effects 3, capital output coefficients world 1 and 3, capital output coefficients world 2, corrosion useful life worlds 1, 2, and 3. Dollar value interindustry and final transactions worlds 1, 2, and 3. Dollar value interindustry differences, 1, 2, dollar value interindustry differences,1-3, and social capital infrastructure. Average annual capital replacement rate worlds 1, 2, and 3. GRA

N79-10198# National Bureau of Standards, Washington, D. C.
ECONOMIC EFFECTS OF METALLIC CORROSION IN THE UNITED STATES. PART 1: A REPORT TO THE CONGRESS BY THE NATIONAL BUREAU OF STANDARDS
L. H. Bennett, J. Kruger, R. L. Parker, E. Passaglia, E. Reimann, A. W. Ruff, H. Yakowitz, and Edward B. Berman (Berman (Edward B.) Associates, Inc., Marblehead, Mass.) May 1978 68 p refs 3 Vol.
(PB-282631/1; NBS-SP-511-1-Pt-1; LC-78-600033) Avail: NTIS HC A04/MF A01; also available in set of 3 reports HC E15, PB-282630-SET CSCL 11F

In 1975, corrosion cost the United States an estimated $70 billion. This was 4.2 percent of the estimated Gross National Product for that year. Of this total, about 15 percent or $10 billion was avoidable. An uncertainty of about + or - 30 percent for the total corrosion cost figure results from inadequate data in some areas and unsure technical and economic judgments. The uncertainty in the avoidable costs is considerably greater. This study used a modified version of the Battelle Columbus Laboratories National input/Output Model. The model quantitatively identifies corrosion-related changes in resources(material, labor, energy, value added), changes in capital stock, and changes in replacement lives of capital stock for all sectors of the economy. The use of this model is well suited for estimating the total direct and indirect costs of corrosion. GRA

N79-10199# Battelle Columbus Labs., Ohio.
ECONOMIC EFFECTS OF METALLIC CORROSION IN THE UNITED STATES. APPENDIX B, PART 2: A REPORT TO NBS BY BATTELLE COLUMBUS LABORATORIES Final Report
J. H. Payer, D. G. Dippold, W. K. Boyd, W. E. Berry, E. W. Brooman, A. R. Buhr, and W. H. Fisher May 1978 252 p refs 3 Vol.
(Contract NBS-7-35716)
(PB-282632/9; NBS-SP-511-2-App-B-Pt-2; LC-78-600033) Avail: NTIS HC A12/MF A01; also available in set of 3 reports HC E15, PB-282630-SET CSCL 11F

The results provide a basis for development of technological, legislative, and other initiatives to promote effective economic savings. The study was confined to corrosion of metals. Input/Output analysis, which provided the methodological framework for this study, permitted detailed and comprehensive treatment of all elements of the costs of corrosion. Production costs, capital costs, changes in replacement lives, etc. were treated in a coordinated and systematic manner. GRA

N79-10200# Bureau of Mines, College Park, Md. Metallurgy Research Center.
A FLUXLESS METHOD FOR RECLAIMING ALUMINUM FROM DROSS
D. Montagna, H. S. Caldwell, Jr., and R. S. Kaplan 1978 21 p refs Presented before the Cast Shop Technol. II, 104th Ann. AIME Meeting, New York, Feb. 1975
(PB-282986/9; BM-RI-8288) Avail: NTIS HC A02/MF A01 CSCL 08I

A fluxless method is described for reclaiming metallic aluminum from aluminum dross. In this method the dross is smelted under argon instead of a high-salt flux. Aluminum recovery is equal to recoveries reported from commercial smelters processing dross in rotary-type furnaces. This salt-free method offers a reduction in air pollution, lower energy requirements due to elimination of salts, and the production of 60 percent less solid waste for disposal than the salt method. GRA

N79-10201# National Bureau of Standards, Washington, D. C. Center for Building Technology.
CORROSION OF METALLIC PIPES TRANSPORTING POTABLE WATER - LABORATORY TESTING METHODS Final Report
Jean N. Andre and James R. Clifton Jun. 1978 38 p refs Prepared in cooperation with Centre Scientifique et Technique du Batiment, Paris (France)
(PB-282509/9; NBS-TN-974) Avail: NTIS HC A03/MF A01 CSCL 11F

Many factors affect both the form of and the corrosion of pipes transporting potable water including the composition, temperature and flow rate of the water, type of metal and the physical condition of the pipe. A pipeline was constructed and experimental methods developed to determine the effects of the above factors on the corrosion of pipes. Components of the pipeline were carefully selected or designed to prevent the occurrence of extraneous corrosion. The rate of corrosion of galvanized steel and copper pipes were measured by direct weight losses measurements and by polarization resistance methods. It appears that the polarization resistance technique is a useful tool which may be used in a variety of corrosion studies of pipe in aqueous media. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N79-10202 Catholic Univ. of America, Washington, D. C.
STRENGTHENING OF GLASSES BY PHASE SEPARATION Ph.D. Thesis
Martin Georg Drexhage 1977 232 p
Avail: Univ. Microfilms Order No. 7816866

A partial leaching method was developed and applied to alkali borosilicate glass rods. It consists of the following steps: (1) melting and forming a glass rod of a phase separable composition; (2) inducing phase separation through proper heat treatment; (3) leaching out one of the phases up to a desired thickness, which leaves a structure having a porous outer layer (clad) surrounding a solid region (core) of substantially the original composition; and (4) washing, drying and heating the sample to sinter the outer porous layer, and cooling the consolidated rod to room temperature in a controlled manner. Factors leading to breakage during the procedure, particularly those due to stresses arising during leaching, were studied theoretically and experimentally. The residual stresses in the consolidated rods were measured photoelastically and through flexural tests. The results are compared with existing theories for the thermal stresses developed in coaxial cylinders. Dissert. Abstr.

N79-10203 Polytechnic Inst. of New York.
THE STABILITY OF NEW TRANSPARENT POLYMERIC MATERIALS: THE EPOXY-TRIMETHOXYBOROXINE SYSTEMS Ph.D. Thesis
Shiow-Ching Lin 1978 191 p
Avail: Univ. Microfilms Order No. 7816756

To prolong the useful life of polymeric materials, the special stabilizers are usually used. Before doing this, the degradation routes have to be understood. In this study, three cured epoxy resins were investigated under various degradation conditions using Fourier Transform Infrared Spectroscopy (FT-IR) for measurement. The thermal stability order of the functional groups in cured DGEBA was total methyl group similar to total benzene ring greater than emthylene greater than p-phenylene greater than ether linkage greater than isopropylidene. The oxidative thermal and photodegradation processes were found to be related to the classical auto-catalytical oxidation for aliphatic hydrogen segments. The Wieland rearrangement, Norrish type reaction, Claisen rearrangement and other possible degradation mechanisms were suggested by the data. Dissert. Abstr.

N79-10204 Massachusetts Univ., Amherst.
STUDIES OF THE CRYSTALLIZATION BEHAVIOR OF THE POLY (1,4 BUTYLENE TEREPHTHALATE)/POLY(ETHYLENE TEREPHTHALATE) BLENDS Ph.D. Thesis
Sisquellas Escala 1978 185 p
Avail: Univ. Microfilms Order No. 7816255

The evidence from wide angle X-ray scattering, differential scanning calorimetry and infrared spectroscopy shows that both polymers crystallize separately in the blends, preserving their unit cell structure, showing separate melting points and their characteristic crystalline spectroscopic bands. A comparative study was made of the effect that annealing or cooling, from the glass or the melt, has on the crystallization behavior.
Dissert. Abstr.

N79-10205 Massachusetts Univ., Amherst.
STUDIES OF POLYMER COMPATIBILITY Ph.D. Thesis
Peter Steven Alexandrovich 1978 283 p
Avail: Univ. Microfilms Order No. 7816225

The compatibility of a series of amorphous polymer/polymer mixtures was studied by a number of experimental techniques, comprising primarily differential scanning calorimetry (DSC) and frequency plane dielectric measurements. Compatible systems considered include blends of poly(2,6-dimethyl-1,4-phenylene oxide) (PPO) with polystyrene (PS), and with random copolymers of parachlorostyrene and styrene (P(pCSS)), orthochlorostyrene and styrene (P(oCS-S)) and parachlorostyrene and orthochlorostyrene (P(pCS-oCS)). The pair polystyrene/poly(orthochlorostyrene) (PS/PoCS) were found to be miscible. Incompatible blends of poly(parachlorostyrene) (PpCS) with both PS and PPO, and incompatible PoCS/PPO mixtures were treated for comparison.
Dissert. Abstr.

N79-10206 Washington Univ., Seattle.
ORTHOGONAL COLLOCATION ON FINITE ELEMENTS WITH APPLICATION TO POLYMER FLOWS Ph.D. Thesis
Ping-Wu Chang 1977 324 p
Avail: Univ. Microfilms Order No. 7814414

The numerical method, orthogonal collocation on finite elements, that uses Hermite approximation on rectangular element is formulated and applied to two-dimensional elliptic problems. Entrance flow, stick-slip flow and die swell problem are solved for Newtonian, power-law and viscoelastic fluids. The flow problems have discontinuous variables and/or a free surface. The nonNewtonian fluids have non-linear responses to the applied stress. The numerical method can handle these difficulties adequately. The entrance length and the excess pressure are observed from the entrance flow solutions. The stick-slip flow reveals the cause of die swell. It is found that the die swell increases as the Reynolds number decreases, the die length decreases, the power-law index increases or the Deborah number increases, all of which phenomena agree with trends measured experimentally. Dissert. Abstr.

N79-10207 Polytechnic Inst. of New York.
EFFECT OF SOLVENT ON THE PROPERTIES OF THE SOLVENT CAST FILMS OF A RANDOM COPOLYMER OF STYRENE-BUTADIENE Ph.D. Thesis
Raymond Meyers 1978 295 p
Avail: Univ. Microfilms Order No. 7816635

Films of a random copolymer of styrene-butadiene (Ameripol 1502 SBR) were cast from benzene, toluene, and ethylbenzene. Films of the acetone extract of this elastomer were cast from benzene, toluene and ethylbenzene as solvents. All films, containing benzoyl peroxide dissolved in the solutions, were dried and then subjected to curing by heating under nitrogen. Results indicate: (1) the poorer the solvent from which the SBR is cast, the greater the degree of covalent crosslinking; (2) larger mechanical (entanglement) crosslinking moduli at 14.5% and at break for films from the better solvents; (3) plots of mechanical (entanglement) and tensile strengths for films cast from a particular solvent showed slopes which increased with speed, the more the better the solvent; and (4) the curing of SBR films with benzoyl peroxide proceeded by way of benzoyl free radical attacks on the double bonds of the butadiene residues. Dissert. Abstr.

N79-10208 Case Western Reserve Univ., Cleveland, Ohio.
CONTROL OF SURFACE CHARGE OF POLYMER LATICES Ph.D. Thesis
Li-Jen Liu 1978 138 p
Avail: Univ. Microfilms Order No. 7816474

Progress is reported in varying the surface charge density in conventional polymerization systems as well as in emulsion-free systems in order to enhance the stability and viscosity of a polymer latex. Methods described include: (1) the use of two azo-type inhibitors to synthesize latices with only acid strong acid surface changes; (2) the use of an initiator to synthesize latices with positive surface charges; (3) the use of ionic comonomers to synthesize latices with positive or negative surface charges; (4) the conversion of unsaturations introduced by monodispersive polybutadiene latex particles into charged groups by treating the latex with bisulfite ions in aqueous phase; and (5) the conversion of benzyl chloride into benzyl sulfonate by treating poly(vinylbenzyl choloride) latex with sodium sulfite in aqueous phase. Dissert. Abstr.

N79-10209 Lehigh Univ., Bethlehem, Pa.
EFFECT OF NETWORK STRUCTURE ON MECHANICAL BEHAVIOR OF EPOXIES Ph.D. Thesis
Subodh Chandra Misra 1978 215 p
Avail. Univ. Microfilms Order No. 7815822

The effects of prepolymer state (bulk, solution, and emulsion) and composition on the network structure, viscoelastic behavior, and ultimate mechanical properties of bisphenol-A-type epoxies are studied. A major question throughout was the distribution of crosslink density at molecular, supermolecular, and microscopic

levels. By using scanning and transmission electron microscopy it was shown that a multi-phase morphology, reflecting variations in crosslink density, is usually developed in curing in bulk, solution or emulsion. In the case of the latter a theory for emulsion curing, which involves both chemical curing and physical coalescence, was proposed after consideration of morphology in conjunction with differential scanning calorimetry. It was shown that emulsion curing is a diffusion controlled process.
Dissert. Abstr.

N79-10210*# Research Triangle Inst., Research Triangle Park, N. C. Camille Dreyfus Lab.
APPROACHES TO FLAME RESISTANT POLYMERIC MATERIALS Final Report
R. Liepins Mar. 1975 37 p refs Sponsored by NASA
(NASA-CR-152205) Avail: NTIS HC A03/MF A01 CSCL 07D

Four research and development areas are considered for further exploration in the quest of more flame-resistant polymeric materials. It is suggested that improvements in phenolphthalein polycarbonate processability may be gained through linear free energy relationship correlations. Looped functionality in the backbone of a polymer leads to both improved thermal resistance and increased solubility. The guidelines used in the pyrolytic carbon production constitute a good starting point for the development of improved flame-resistant materials. Numerous organic reactions requiring high temperatures and the techniques of protected functionality and latent functionality constitute the third area for exploration. Finally, some well-known organic reactions are suggested for the formation of polymers that were not made before. G.G.

N79-10211*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FORMULATION OF MS-74 WHITE THERMAL-CONTROL COATING AND REVISED APPLICATION PROCEDURES
C. M. Shai and Jules Hirschfield Feb. 1978 9 p ref Supersedes X-757-76-169 Submitted for publication
(NASA-TM-78086; X-757-76-169) Avail: NTIS HC A02/MF A01 CSCL 11D

Procedures are given for formulating, blending, and applying MS-74 white thermal-control coating and CC-1 primer to spacecraft structures. Improved ultraviolet stability, higher emittance and low absorptivity, and enhanced adhesion characteristics result from the revised procedures. A.R.H.

N79-10212# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
HOMOGENEOUS AND HETEROGENEOUS BLENDS OF POLYBUTADIENE, POLYISOPRENE AND CORRESPONDING DIBLOCK COPOLYMERS
R. E. Cohen and A. R. Ramos 6 Jul. 1978 27 p refs
(Contract N00014-77-C-0311)
(AD-A056726; TR-2) Avail: NTIS HC A03/MF A01 CSCL 11/9

The miscibility of homogeneous diblock copolymers of 1-4-polybutadiene and cis-1-4 polyisoprene with either or both of the corresponding linear homopolymers was found to depend upon the relative lengths of the block segments and upon the coordinates of the binary or ternary mixture on the appropriate triangular composition diagram. Evidence from a variety of experiments was used to draw overall conclusions regarding the location of the diblock in these blends and its influence on physical properties. GRA

N79-10213# Texas Engineering Experiment Station, College Station.
THE SIGNIFICANCE OF TIME-DEPENDENT BEHAVIOR OF STRUCTURAL ADHESIVES Final Report, 1 Sept. 1977 - 31 May 1978
William B. Jones, ed. and Barbara A. Mahoney, ed. 1978 215 p Workshop held at Grand prairie, Tex., 5-6 Dec. 1977
(Grant AF-AFOSR-3459-77)
(AD-A057198; AFOSR-TR-78-1194) Avail: NTIS HC A10/MF A01 CSCL 11/1

This report summarizes the results of a workshop on the significance of time-dependent behaviors of structural adhesives. This report contains the visual aid material used by the speakers during the workshop. In addition the conclusion reached by panels are presented which considered the following topics: Material Characterization, Analytical Problems Related to Adhesive Bonds, and Experimental Mechanics. Author (GRA)

N79-10214# Akron Univ., Ohio. Inst. of Polymer Science.
CHEMISTRY OF SILANE COUPLING REACTIONS. PART 2: REACTION OF DIMETHYLMETHOXYSILANATED POLY (BUTADIENE) WITH TRIETHYLSILANOL AND WITH GLASS
P. Dreyfuss, L. J. Fetters, and A. N. Gent 11 Jul. 1978 24 p refs
(Contract N00014-76-C-0408; NR Proj. 092-555)
(AD-A056583; TR-4) Avail: NTIS HC A02/MF A01 CSCL 13/8

Poly(butadiene) having a dimethylmethoxysilane endgroup has been found to react with a model silanol, triethylsilanol, in the same way as a simple silane does, yielding the addition product, methanol, and dimers of the two starting materials. This reaction takes place readily at room temperature in benzene solution. A corresponding addition reaction between silanated poly(butadiene) and the OH groups present on the surface of glass has therefore been inferred. This is corroborated by a greater degree of retention of silanated poly(butadiene) compared to unsilanated poly(butadiene) on glass slides subjected to thorough washing, and by direct observation of polymer particles, about 0.3 micrometer in size, adhering to the glass treated with silanated poly(butadiene). Author (GRA)

N79-10215# Army Inst. of Dental Research, Washington, D. C.
A COATING AGENT FOR PROMOTION OF METAL-TO-PORCELAIN BONDING
Eugene F. Huget and Laszlo B. Desimon Jun. 1978 9 p refs
(AD-A056450) Avail: NTIS HC A02/MF A01 CSCL 11/2

Since the early 1950's, esthetic porcelain-fused-to-metal dental treatment devices have enjoyed wide clinical use. The following problems, however, initially encumbered the production of porcelain-metal dental restoration: (1) Fused porcelain displayed cracks after firing because of the mismatch of thermal expansion between the porcelain and the metal substructure; (2) the color of fused porcelain was altered adversely by color forming oxides and by technique; (3) relatively soft gold-based casting alloys lacked sufficient strength and rigidity to withstand rigorous functional service. Over the past decade, the foregoing difficulties have been reduced in frequency of occurrence and in severity. Today, the degree of bonding of fused porcelains to improved gold-containing (precious) alloys appears to be adequate. However, the mechanisms by which bonding occurs are not understood completely. Several explanations of the so-called porcelain-to-metal bond have been advanced. Van der Waal's forces, and the beneficial effects of compression forces resulting from small differences in thermal expansion of two dissimilar phases may contribute to bond formation. GRA

N79-10216# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
US ARMY/ENVIRONMENTAL PROJECTION AGENCY RE-REFINED ENGINE OIL PROGRAM Progress Report, Oct. 1976 - May 1978
Edwin A. Frame and Thomas C. Bowen, Jr. May 1978 34 p refs
(Contracts DAAK70-78-C-0001; DAAG53-76-C-0003)
(AD-A056806; AFLRL-98) Avail: NTIS HC A03/MF A01 CSCL 11/8

Re-refined base oils were obtained and analyzed. Based on the analyses, six oils were formulated to MIL-L-46152 quality level using the same concentration of a single additive package. The formulated oils were tested against the requirements of MIL-L-46152. One oil passed all the engine tests. Vehicles from City of San Diego which operated on re-refined oil were disassembled and inspected for deposits. Author (GRA)

N79-10217# General Electric Co., Schenectady, N. Y. Corporate Research and Development.
LEAD ZIRCONATE TITANATE (LZT) CERAMICS Annual Summary Report, 1 May 1977 - 30 Apr. 1978
J. H. Rosolowski, R. H. Arendt, and J. W. Szymaszek Jun.

1978 49 p refs
(Contract N00014-76-C-0659)
(AD-A057140; SRD-78-096) Avail: NTIS HC A03/MF A01 CSCL 11/2

Tests of batch-to-batch reproducibility of LZT powders made by molten salt synthesis were carried out by measuring the properties of ceramics fired from them. Individual post-poling dielectric constants and planar coupling coefficients lay within plus or minus 4% and plus or minus 7%, respectively, of the average of all samples fired in the same way. Striking similarities in characteristic aging behavior of the dielectric constant among all samples from all powder batches that were fired in the same way were observed. The characteristics changed with the firing method. Tests of poling behavior indicate an effect of post-firing history on properties achieved in subsequent polings of a sample. The presence of unreacted zirconia in the starting powder was found to be deleterious to ceramic properties. GRA

N79-10218# California Univ., Livermore. Lawrence Livermore Lab.
STRESS-RUPTURE DATA FOR KEVLAR 49/EPOXY STRANDS
Lynn Penn 13 Mar. 1978 12 p
(Contract W-7405-eng-48)
(UCID-17738) Avail: NTIS HC A02/MF A01

Raw data obtained from a study of the stress-rupture behavior of filament-wound organic fiber/epoxy strain specimens are tabulated. DOE

N79-10219# Argonne National Lab., Ill.
FEASIBILITY OF USING INFRARED SCANNING TO TEST FLAWS IN CERAMIC MATERIALS
C. K. Hsieh (Florida Univ., Gainesville) and W. A. Ellingson 1977 10 p refs Presented at 15th Intern. Thermal Conductivity Conf., Ottawa, 24 Aug. 1977
(Contract W-31-109-eng-38)
(CONF-770847-2) Avail: NTIS HC A02/MF A01

The feasibility of using infrared scanning systems to test the integrity of refractory materials was established through the use of a 60% aluminum oxide refractory. Heat was injected from the back side of the rectangular sample and scanning with the infrared system was performed on the front surface. To minimize the lateral heat dissipation from the sample, a nichrome heating wire was embedded in a narrow groove cut around the view field; the scanning surface was painted black to minimize the background-reflection effects. Prior to tests the ground level surface energy was scanned in a two dimensional array. Follow-up scans were made after various defects were simulated on the back side of the sample. By means of an image processing technique, the ground level surface energy and noise effects were removed from the scanned data. This also permitted the processed data to reveal the true effects due to material defects. In the experiment, the scanned thermal patterns were analyzed to obtain six features for comparison. DOE

N79-10220# Oak Ridge Y-12 Plant, Tenn.
STUDY OF POLYURETHANE CURE BY INFRARED SPECTROPHOTOMETRY
A. Chambles Sep. 1977 20 p refs
(Contract W-7405-eng-26)
(Y/DK-183) Avail: NTIS HC A02/MF A01

An infrared method of studying residual isocyanate (NCO) in polyurethane parts was explored. Two mixtures of resins and hardeners studied over an extended length of time were 18.2 percent Hylene-W/72.7 percent LW-520/9.1 percent CA-463 and 85.5 percent Halthane/14.5 percent MDIPA. DOE

N79-10221# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
EFFECT OF SOME THERMOMECHANICAL VARIABLES ON PLASTIC FLOW AND CREEP-RUPTURE OF TYPE 304 STAINLESS STEEL AT 593 DEG C
R. W. Swindeman 1977 29 p refs Presented at the Ann. Winter Meeting of ASME, Atlanta, 27 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771120-15) Avail: NTIS HC A03/MF A01

Specimens of type 304 stainless steel, subjected to a variety of prior thermomechanical treatments, were tested. For material with coarse grain size, reannealing temperature had no pronounced influence, but slow cooling rates and the 816 C aging significantly extended the rupture life. Cold working by an equivalent of 4% tensile strain had very little influence on rupture life. Slow cooling or aging increased rupture life as a result of greatly improved creep ductility. This is believed to be due to the development of coarse, beneficial carbides on grain boundaries before stressing. The creep response in the primary and secondary stages was influenced by nearly all the thermomechanical treatments, but the variability in the response at relatively high stresses was scarcely greater than the variability observed in multiple tests on specimens having a common thermomechanical history. DOE

N79-10222# National Technical Information Service, Springfield, Va.
HEAT RESISTANT PLASTICS. PART 1. NITROGEN CONTAINING POLYMERS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Jul. 1978
Diane M. Cavagnaro Aug. 1978 185 p Supersedes NTIS/PS-77/0693; NTIS/PS-76/0588; NTIS/PS-75/560
(NTIS/PS-78/0769/6; NTIS/PS-77/0693; NTIS/PS-76/0588; NTIS/PS-75/560) Avail: NTIS HC $28.00/MF $28.00 CSCL 11I

The reports cited cover the synthesis, application, testing, decomposition, and properties of heat resistant nitrogen containing polymers. Two major polymers discussed are polyquinoxalines and polybenzimidazoles. This updated bibliography contains 178 abstracts, 30 of which are new entries to the previous edition. GRA

N79-10223# National Technical Information Service, Springfield, Va.
HEAT RESISTANT PLASTICS. PART 2. SILICONE, CARBORANE, HALOCARBON, AND OTHER POLYMERS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Jul. 1978
Diane M. Cavagnaro Aug. 1978 181 p Supersedes NTIS/PS-77/0695; NTIS/PS-76/0587; NTIS/PS-75/561
(NTIS/PS-78/0770/4; NTIS/PS-77/0695; NTIS/PS-76/0587; NTIS/PS-75/561) Avail: NTIS HC $28.00/MF $28.00 CSCL 11I

Research on heat resistant plastics and elastomers except nitrogen containing polymers is cited with emphasis on the following resins: polysilicones, polycarboranes, phosphorus containing polymers, and halocarbon polymers. The chemical properties, synthesis, physical and mechanical properties, applications, and fabrication of these polymers are covered. This updated bibliography contains 174 abstracts, 39 of which are new entries to the previous edition. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N79-10224*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SILICONE CONTAINING SOLID PROPELLANT Patent Application
Kumar N. R. Ramohalli, inventor (to NASA) (JPL) Filed 16 Oct. 1978 12 p
(Contract NAS7-100)
(NASA-Case-NPO-14477-1; US-Patent-Appl-SN-951830) Avail: NTIS HC A02/MF A01 CSCL 21I

The invention relates to elimination of aluminum oxide slag deposit in the nozzle throat of laboratory scale end burner units utilized in developmental programs which interferes with testing of metal containing solid rocket propellants for L-star instability characteristics. Addition of a small amount of a liquid silicone oil to a metal containing solid rocket propellant provides a significant reduction in heat transfer to the inert nozzle walls eliminating or reducing metal oxide slag collection and blockage of the nozzle throat. It was further discovered that the burning

rate of these propellants is increased by about 5 to 10% providing improved ballistic performance. NASA

N79-10225*# National Aeronautics and Space Administration. Pasadena Office, Calif.
RECOVERY OF ALUMINUM AND BINDER FROM COMPOSITE PROPELLANTS Patent Application
Graham C. Shaw, inventor (to NASA) (Thiokol Chemical Corp., Brigham City, Utah) Filed 29 Sep. 1978 14 p
(Contract JPL-954161)
(NASA-Case-NPO-14110-1; US-Patent-Appl-SN-947000) Avail: NTIS HC A02/MF A01 CSCL 21I

The metal fuel powder and the resin are recovered from propellant binder containing less than 15% oxidizer salt by dissolution of the binder in an active transesterification solvent such as an alcoholic solution of an alkali metal alkoxide of the formula MOR where M is an alkali metal suitably sodium or potassium and R is an alkly group containing 1 to 6 carbon atoms. The alcohol is an alkanol containing 1 to 6 carbon atoms. When moisture is excluded from the system, the highly basic alkyl oxide radical has little effect upon the Al present, but reacts very rapidly with the binder. Mixed solvents of either methanol and tetrahydrofuran or toluene were effective in the transesterification reactions. The products of the reaction were soluble in toluene. Washing the binder from the Al generally resulted in the recovery of 98.7 to 99.7% of the theoretical amount. Analysis for active aluminum content ranged from 98.5 to 98%. The low oxidizer aluminum-binder residue is obtained by an aqueous leach of the scrap propellant. NASA

N79-10226*# Southwest Research Inst., San Antonio, Tex.
WORKBOOK FOR ESTIMATING EFFECTS OF ACCIDENTAL EXPLOSIONS IN PROPELLANT GROUND HANDLING AND TRANSPORT SYSTEMS Final Report
W. E. Baker, J. J. Kulesz, R. E. Ricker, P. S. Westine, V. B. Parr, L. M. Vargas, and P. K. Moseley Aug. 1978 274 p refs
(Contract NAS3-20497)
(NASA-CR-3023; Rept-02-4778) Avail: NTIS HC A12/MF A01 CSCL 21D

A workbook is presented to supplement an earlier NASA publication, which was intended to provide the designer and safety engineer with rapid methods for predicting damage and hazards from explosions of liquid propellant and compressed gas vessels used in ground storage, transport and handling. Information is presented in the form of graphs and tables to allow easy calculation, using only desk or handheld calculators. Topics covered in various chapters are: (1) estimates of explosive yield; (2) characteristics of pressure waves; (3) effects of pressure waves; (4) characteristics of fragments; and (5) effects of fragments and related topics. Author

N79-10227*# National Aeronautics and Space Administration. Pasadena Office, Calif.
PROCESS FOR THE LEACHING OF AP FROM PROPELLANT Patent Application
Graham C. Shaw (Thiokol Corp., Brigham City, Utah) and Meldon J. McIntosh, inventors (to NASA) (Thiokol Corp., Brigham City, Utah) Filed 29 Sep. 1978 17 p
(Contract JPL-954161)
(NASA-Case-NPO-14109-1; US-Patent-Appl-SN-946990) Avail: NTIS HC A02/MF A01 CSCL 21I

The invention relates to recovery of inorganic oxidizing salt such as ammonium perchlorate (AP) from waste propellant. In a method of recovery of AP by leaching the chunks agglomerate, requiring continuous high energy mixing. In the invention, the agglomeration of the propellant is prevented by the addition of surface active agents which are absorbed upon the propellant binder surfaces, reducing the tacky nature of the exposed surfaces. The power required to mix the water slurried propellant was less than 1/50th that required to mix the pyrotechnic materials having the tacky nature of the wet agglomerated propellant and not containing the dispersing agent. Extraction of up to 98% AP was achieved from slurries containing over 40% propellant. The chemical purity of the recovered AP is acceptable for reuse in propellant compositions, for resale or for use in slurried explosives. NASA

N79-10228# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
PROPELLANT SURVEILLANCE REPORT. LGM-3 A AND B STAGE 1, TP-H1011
John A. Thompson May 1978 106 p
(AD-A056729; MANCP-393(78)) Avail: NTIS HC A06/MF A01 CSCL 21/9

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30 A and B First Stage Minuteman Motors. This report is the fourteenth time that a statistical approach has been used to analyze First Stage bulk carton propellant. Testing was accomplished in accordance with MMEMP Project M82934C-WNL17514. The purpose of testing was to determine and provide early warning of any serious degradation trends occurring in the propellant for service life predictions. An analysis of all parameters indicates that no potential problems are expected in the propellants for at least two years past the oldest data point. Data stored in the G085 System were plotted utilizing the IBM 360-65 Computer and CAL-COMP Plotter. The data range at any age can be found by suitable inquiry of the G085 System. Each point on the regression plot represents the mean of all samples at that particular age. The number of specimens at each point is indicated on the sample size summary sheet accompanying each regression plot or group of regression plots. Author (GRA)

N79-10229# Army Missile Research and Development Command, Redstone Arsenal, Ala.
THE EFFECTS OF AN IMMISCIBLE BINDER COMPONENT ON THE RHEOLOGICAL AND MECHANICAL PROPERTIES OF A COMPOSITE SOLID PROPELLANT
Henry C. Allen and Marjorie T. Cucksee Jun. 1978 15 p
(AD-A056401) Avail: NTIS HC A02/MF A01 CSCL 21/9

The Improved HAWK antiaircraft missile is powered by the M112 rocket motor. This motor operates in boost and sustain modes derived from concentric booster and sustainer composite solid propellant grains (Figure 1). The booster propellant is relatively fast burning to provide the thrust level necessary to accelerate the missile to intercept velocity, while the sustainer propellant burns slowly over a much longer time to maintain missile velocity and maneuverability during the mission. The booster grain is fully bonded to the sustainer grain which in turn is fully bonded to the steel motor case by means of an adhesive case liner. GRA

N79-10230# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
EXPLOSION ON A SINGLE MOLECULE LEVEL: A CONCEPTUAL MODEL BASED ON IONIZATION AND FRAGMENTATION OF TNT UNDER ELECTRON IMPACT
Suryanarayana Bulusu Jun. 1978 14 p refs
(AD-A056414) Avail: NTIS HC A02/MF A01 CSCL 19/1

Several studies of the mass spectra of nitroaromatic compounds have appeared in recent literature with emphasis on either analytical applications or on the modes of electron impact fragmentation. The chemistry of the nitroaromatic compounds is of considerable interest to the field of explosives because of the central role played by TNT (2-4-6-trinitrotoluene) in a wide variety of armaments. Electron impact studies of explosives and related substances were initiated in this laboratory in order to provide a comparison with other modes of decomposition such as by heat, light and ionizing radiation. The knowledge thus gained should provide an insight into the nature of the chemical species and processes preceding detonation. GRA

N79-10231# Army Missile Research and Development Command, Redstone Arsenal, Ala.
THE PRODUCTION OF DECARBORANE-14 FROM DIBORANE BY LASER INDUCED CHEMISTRY
James A. Merritt, Harry C. Meyer, Raymond I. Greenberg, and George A. Tanton Jun. 1978 15 p refs
(AD-A056467) Avail: NTIS HC A02/MF A01 CSCL 21/9

Pure B10H14 can be produced in high yields at room temperature by laser induced chemistry (LIC). No polymer (which is always present in pyrolysis) was observed when the laser power was kept below a certain threshold (10 W/sq cm for the CO2 laser). Also, the B5H11 product is always present in pyrolysis; yet never observed in LIC synthesis. This research

demonstrates that LIC is a new viable area of chemistry that can be used for cost-effective synthesis of large poly-atomic molecules as well as smaller ones. Also, it demonstrates that LIC can be used in a prominent role for the synthesis of high energy binder molecules, burning rate modifiers and fuel additives with a substantial cost-savings. GRA

N79-10232# Army Missile Research and Development Command, Redstone Arsenal, Ala.

A NONLINEAR CONSTITUTIVE RELATIONSHIP FOR COMPOSITE PROPELLANTS

Donald L. Martin, Jr. Jun. 1978 15 p refs

(AD-A056465) Avail: NTIS HC A02/MF A01 CSCL 21/9

A nonlinear constitutive relationship is developed for uniaxial stress-strain conditions that are shown to fit experimental data over a wide range of strain rates and temperatures. The total stress-strain nonlinearity of particulate filled composites may be represented by statistical parameters similar to those used by Farris to describe the dilatation-strain behavior. The dilatational behavior of composite propellants may be predicted from the stress-strain data and the total filler content. The relationships derived in this report will enable one to investigate the nonlinear behavior at strain-rates and temperatures where it is very difficult, if not impossible, to obtain measured dilatation data. GRA

N79-10233# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.

THE EFFECT OF OXIDIZER PARTICLE SIZE DISTRIBUTION ON THE STEADY AND NONSTEADY COMBUSTION OF COMPOSITE PROPELLANTS Final Report

J. A. Condon and J. R. Osborn Jun. 1978 228 p refs

(Contract F04611-76-C-0067)

(AD-A056892; AFRPL-TR-78-17) Avail: NTIS HC A11/MF A01 CSCL 21/9

A theoretical analysis of the combustion of composite propellants (with an emphasis on the heterogeneous effects) is presented. The analysis is based on the combination of a unique statistical treatment of the burning surface with a very comprehensive multiple flame type of physiochemical model for the combustion process. The analysis is divided into four parts: the steady state burning rate, erosive burning rate, the pressure coupled response, and the velocity coupled response. GRA

N79-10234# Picatinny Arsenal, Dover, N. J. Feltman Research Lab.

INVESTIGATIONS OF PROPELLANT AND EXPLOSIVE SOLID SOLUTION SYSTEMS. 1. CRYSTAL SYNTHESIS

Scott I. Morrow, Nathanial Gelber, and Roscoe Croom Army Armament Res. and Develop. Lab. May 1978 47 p refs

(DA Proj. 1T0-61101-A-91A)

(AD-A056796; AD-E400166) Avail: NTIS HC A03/MF A01 CSCL 19/1

A new approach was discussed and tried for making unique new oxidizer type materials for use in solid propellants. This involved theoretical identification of promising systems of isomorphous oxidizer, solid-solution mixed crystals. To make these materials for evaluation purposes required the selection of the most rigorous method possible so that the product would have a maximum opportunity of being homogeneous. This synthesis technique was isothermal cocrystallatization, a procedure normally utilized in phase rule chemistry in studying the behavior of a salt pair in a solvent such as water at constant temperature. Three types of isomorphous solid solutions were the object of principal concern, namely the AP-KP, AP-AN, and AN-KN pairs. Published phase rule data on the ternary systems of the above three respective salt pairs in water were used as a basis for making solid solutions of selected compositions. New techniques were devised and tested successfully for making larger quantities than would normally be possible by the strict phase rule approach. In some cases, particularly with the AP-AN solid solutions, the desired degree of product homogeneity was difficult to attain. Effectiveness of the grinding operation of the product, as it was being formed, proved to be of critical importance in the attainment of product homogeneity. Solid solutions of the above-mentioned types were successfully prepared for characterization studies. Author (GRA)

N79-10235# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.

MOLECULAR STUDIES OF THE MECHANISM OF SHOCK INITIATION OF SOLID EXPLOSIVES

F. J. Owens, J. Sharma, and D. A. Wiegand Jun. 1978 15 p refs

(AD-A056472) Avail: NTIS HC A02/MF A01 CSCL 21/2

Important understanding has been gained about the process of shock induced exothermic reactions in solid explosives. The initial step in the process has been shown to involve a breaking of intra molecular bonds or an altering of the bonds of the explosive molecules which make up the lattice of the material and a production of trapped radicals. These trapped radicals are likely candidates for the secondary reactions. It is also shown that this bond breaking is accompanied by considerable permanent distortion in the lattice. GRA

N79-10236# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. Quality Div.

TIME MEASUREMENTS FOR QUALITY CONTROL OF EXPLOSIVE COMPONENTS

Rex Avara Apr. 1978 14 p

(Contract EY-76-C-04-0487)

(MHSMP-78-16) Avail: NTIS HC A02/MF A01

Statistical sampling is employed in quality control of explosive components. Because the samples are destroyed in testing, proper techniques must be developed to obtain the necessary information with adequate precision and minimum risk of equipment failure. A streak camera electro-optical system is used to measure time dependent data, i.e., velocity, acceleration, simultaneity, etc. A technique for measuring a component transit time and the simultaneity across the face of an explosive shocked brass cone is described. DOE

N79-10237# Garrett Energy Research Engineering, Inc., Claremont, Calif.

CONVERSION OF BIOMASS MATERIALS INTO GASEOUS PRODUCTS, PHASE 1 Final Technical Report, 25 May 1976 - 24 Jun. 1977

Donald E. Garrett Oct. 1977 143 p refs

(Contract E(04-3)-1241)

(SAN/1241-77/1) Avail: NTIS HC A07/MF A01

A one year exploratory bench scale pilot plant and laboratory study was completed on proprietary double effect dryer-multiple hearth biomass pyrolysis process. The results indicate that an initial vacuum drying stage is quite feasible, and that an effective overall heat transfer coefficient of 4.5 Btu/hr x sq. ft. x F can be obtained for the flue gas-vacuum dryer. Direct contact drying was also efficiently conducted in the hearths, with an effective overall drying rate for manure of about 5 lbs water/hr x cu. ft. of hearth space. Acceptably low solids entrainment and lack of hearth plugging occurred at a flue gas velocity of 0.1 ft/sec, and 60 ft/sec through the base plate holes. The 450 Btu/cu ft (dry, carbon dioxide-free) product gas was obtained in about a 74% yield, was low in carbon monoxide, and should be blendable into natural gas pipelines. Costs are estimated for constructing a 100 t/d manure processing plant producing a medium Btu gas for $2.84/MMBtu, if manure is free, with a 10% return on investment. DOE

N79-10238# Rice Univ., Houston, Tex. Dept. of Chemical Engineering.

PHASE EQUILIBRIA IN COAL HYDROGENATION SYSTEMS Quarterly Report, Jul. - Sep. 1977

Riki Kobayashi Nov. 1977 23 p refs

(Contract EX-76-S-01-2334)

(FE-2334-6) Avail: NTIS HC A02/MF A01

Zone purification of organic compounds for eventual study is continued. Samples thus far refined in large quantities include phenanthrene, naphthalene, biphenyl, dibenzofuran, fluoranthene and alpha-methylnaphthalene. Dew point/vapor pressure measurements of toluene at low temperature were completed. The results are attached as an appendix. The high temperature bath for the measurement of pure component dew points was completed and is expected to become operational during the coming quarter. DOE

N79-10239# Mound Lab., Miamisburg, Ohio.
CHARACTERIZATION OF EXPLOSIVES BY OBSERVING GROWTH TO DETONATION USING A FIBER OPTICS SYSTEM
J. H. Mohler and W. J. Moodie 1977 24 p Presented at 2nd Ann. Firing-System Conf., Los Alamos, N. Mex., 8 Nov. 1977
(Contract EY-76-C-04-0053)
(MLM-2478(OP); Conf-771133-1) Avail: NTIS HC A02/MF A01

A system was developed to observe the growth to detonation of high explosives using fiber optics to monitor light emission at the detonations front. The corresponding voltage waveform is digitized and fed to a computer for peak location and data analysis. Measurements close to the initiation point revealed an acceleration zone in which the velocity for growth to final detonation occurs. The characteristics of this acceleration region are related to the physical properties and sensitivity of the test explosive. DOE

N79-10240# National Academy of Sciences - National Research Council, Washington, D. C. Board on Science and Technology for International Development.
METHANE GENERATION FROM HUMAN, ANIMAL, AND AGRICULTURAL WASTES
1977 136 p refs
(Contract AID/CSD-2584)
(PB-276469/4; LC-77-92794) Avail: NTIS HC A07/MF A01 CSCL 07A

The following topics are discussed: (1) system description and economic feasibility of methane production; (2) technology of anaerobic fermentation; (3) engineering process design; and (4) research and development needs. GRA

N79-10241# Minnesota Univ., Minneapolis. Center for Study of the Physical Environment.
BIOMASS UTILIZATION IN MINNESOTA Research Report, Mar. 1975 - Sep. 1977
Perry L. Blackshear, Jr., Roger Aiken, and Roger A. Peterson Nov. 1977 331 p refs Sponsored by Minnesota Pollution Control Agency
(PB-282531/3) Avail: NTIS HC A15/MF A01 CSCL 21D

Contents: pyrolysis; crop residues as energy sources-assessing the cost and energy feasibility of direct firing; cost and energy assessment of alternate uses of crop and timber residues in Minnesota; anaerobic digestion of crop residues for methane generation as an adjunct to farming; energy recovery on the farm by anaerobic digestion of animal manures; ammonia volatilization from animal manures; effect upon soil properties of utilization of plant residues for fuel energy; and waste cellulose conversion to sugars by cellulose enzymes. GRA

N79-10242# Kansas Water Resources Research Inst., Manhattan.
PHOTOCHEMICAL GENERATION OF HYDROGEN FROM WATER Project Completion Report, 1 Jul. 1974 - 30 June. 1976
Jack L. Lambert and J. V. Paukstelis Nov. 1977 12 p refs
(Contract DI-14-31-0001-5016)
(PB-282592/5; Contrib-194; W78-08141; OWRT-A-062-KAN(1)) Avail: NTIS HC A02/MF A01 CSCL 97D

Synthetic iron-sulfur clusters resembling those found in ferrodoxin-type enzymes were studied during a search for a chemically-stable compound that will absorb the photons of sunlight and dissociate water into hydrogen and oxygen. The compound must not undergo permanent change but be regenerated to take part in the cyclic process. The investigation was not successful because it did not reach the stage where the resin-supported iron-sulfur clusters were made and tested. GRA

N79-10243# Science Applications, Inc., La Jolla, Calif.
PROCEEDINGS OF THE ENGINEERING FOUNDATION CONFERENCE ON CLEAN COMBUSTION OF COAL
Apr. 1978 329 p refs Conf. Held at Rindge, New Hampshire, 1-5 Aug. 1977 Sponsored in part by Bureau of Mines, Pittsburgh, Pa.
(Grant EF-77-G-01-6003)
(PB-282949/7; EPA-600/7-78-073) Avail: NTIS HC A15/MF A01 CSCL 21D

The proceedings document the 27 presentations made at a Conference concerning technical, economic, environmental, and policy aspects of clean combustion of coal. The five Conference sessions dealt with problem definition, precombustion processes, combustion processes, postcombustion processes, and future prospects. The Conference was intended to provide an assessment of the status and trends of clean combustion of coal. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N79-10244 Polytechnic Inst. of New York.
DYNAMIC RESPONSE OF STRUCTURE IN FREQUENCY DOMAIN Ph.D. Thesis
Ahmed Maher Sayed Ahmed Abdelrahman 1978 83 p
Avail: Univ. Microfilms Order No. 7816740

The dissertation contains two parts. Part 1 deals with the subcritical excitation and dynamic response of structures in frequency domain. Part 2 deals with the along-wing gust effect on elevated structures, which is of major importance to structural engineers. Dissert. Abstr.

N79-10245*# National Aeronautics and Space Administration. Pasadena Office, Calif.
AN IMPROVED SYSTEM FOR SLICING SILICON WAFERS Patent Application
Earl R. Collins, inventor (to NASA) Filed 16 Oct. 1978 17 p
(Contract NAS7-100)
(NASA-Case-NPO-14406-1; US-Patent-Appl-SN-951828) Avail: NTIS HC A02/MF A01 CSCL 13H

A system is presented for simultaneously slicing from a plurality of silicon boules, arranged in side-by-side relation, a multiplicity of high-grade wafers for use in the semiconductor industry. The system includes a plurality of band saw blades supported for simultaneous unidirectional displacement along parallel courses extending through a common cutting station. The blades are provided with serrations, the purpose of which is to transport a cutting slurry picked-up at jets for enhancing cutting operation. Each of the blades is supported at the cutting station by a plurality of guides driven in rotation in a manner such that the guides are angularly displaced through 180 degrees during each cutting operation for continuously presenting to the blade regenerated supporting surfaces whereby blade wobble is reduced. NASA

N79-10246*# National Aeronautics and Space Administration. Pasadena Office, Calif.
SUPPORT ASSEMBLY FOR CRYOGENICALLY COOLABLE LOW-NOISE CHOKED WAVEGUIDE Patent Application
Frank E. McCrea, inventor (to NASA) (JPL) Filed 31 Aug. 1978 11 p
(Contract NAS7-100)
(NASA-Case-NPO-14253-1; NASA-Case-NPO-14640-1; US-Patent-Appl-SN-938293) Avail: NTIS HC A02/MF A01 CSCL 20N

An assembly that has low noise characteristics and low heat transfer for supporting a waveguide through cryogenically cooled space is presented. The novelty of the invention resides in the use of stainless steel tubes to support a waveguide from a mounting plate in the manner described to provide a thermal conduction path of high impedance with such structural rigidity that the waveguide is held with the proper choke gap and in proper alignment. These structures can be used in tandem to support a waveguide through two cooling stages at vastly different temperatures such as 300 K outside, 4 K inside and 70 K in the intermediate stage. NASA

N79-10247# Bendix Corp., Kansas City, Mo.
ALUMINA LAPPING ABRASIVE STUDY
R. D. Wagner Oct. 1977 24 p refs
(Contract EY-76-C-04-0613)
(BDX-613-1692) Avail: NTIS HC A02/MF A01

To achieve greater quality control over lapped finishes, the 3 and 0.3 mm alumina abrasives used in rough and finish lapping

were studied. The 3 mm abrasive was found to actually average 5 to 10 mm. The particle size distribution of the 0.3 mm abrasive could not be determined with sufficient accuracy. Recommendations for procurement, storage, dispensing, and mixing were made to provide increased abrasive uniformity and freedom from contamination. DOE

N79-10248# Allied Chemical Corp., Idaho Falls, Idaho. Idaho Chemical Programs - Operations Office.
PHYSICAL PROPERTIES AND HEAT TRANSFER CHARACTERISTICS OF MATERIALS FOR KRYPTON-85 STORAGE
A. B. Christensen Sep. 1977 46 p refs
(Contract EY-76-C-07-1540)
(ICP-1128) Avail: NTIS HC A03/MF A01

The physical properties of krypton and of potential krypton-85 storage materials which are required to calculate the maximum temperature developed during storage are evaluated. Temperature calculations were made for krypton-85 stored as a gas or immobilized solid in steel storage cylinders. The effects of krypton-85 loading, cylinder radius, storage media properties, and exterior cooling on storage temperature are shown. DOE

N79-10249# National Technical Information Service, Springfield, Va.
SURFACE EFFECT VEHICLE/SHIPS IN MARINE ENVIRONMENTS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1978
Guy E. Habercom, Jr. Aug. 1978 230 p Supersedes NTIS/PS-77/0646; NTIS/PS-76/0503; NTIS/PS-75/332 3 Vol.
(NTIS/PS-78/0862/9; NTIS/PS-77/0646; NTIS/PS-76/0503; NTIS/PS-75/332) Avail: NTIS HC $28.00/MF $28.00 CSCL 13J

Surface effect ships and vehicles and their aerodynamic characteristics are investigated in these government-sponsored research reports. Technical and operational characteristics are reviewed. This updated bibliography contains 223 abstracts, 16 of which are new entries to the previous edition. GRA

N79-10250# National Technical Information Service, Springfield, Va.
SURFACE EFFECT VEHICLES/SHIPS IN MARINE ENVIRONMENTS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1972 - Jun. 1978
Guy E. Habercom, Jr. Aug. 1978 172 p Supersedes NTIS/PS-77/0647; NTIS/PS-76/0504 3 Vol.
(NTIS/PS-78/0863/7; NTIS/PS-77/0647; NTIS/PS-76/0504) Avail: NTIS HC $28.00/MF $28.00 CSCL 13J

Surface effect ships and vehicles and their aerodynamic characteristics are investigated in these research reports gathered from worldwide literature surveys. Technical and operational characteristics are reviewed. This updated bibliography contains 165 abstracts, 23 of which are new entries to the previous edition. GRA

N79-10251# National Bureau of Standards, Washington, D. C.
A LITERATURE REVIEW OF FIRE AND LIVE LOAD SURVEYS IN RESIDENCES Final Report
Lionel A. Issen May 1978 29 p refs Sponsored in part by HUD
(PB-281464/8; NBSIR-78-1440) Avail: NTIS HC A03/MF A01 CSCL 13M

A search of the literature shows that most load surveys were concerned with commercial and industrial occupancies and only a few have dealt with residences. Many surveys were inadequately reported from a statistical viewpoint, and the data have been misapplied. A common error was to assume that the largest observed load is the largest expected load. The statistics of extremes should be used to determine reasonable design values. Methods for estimating the sampling size (for a prescribed accuracy) are given and illustrated with examples. GRA

N79-10252# National Technical Information Service, Springfield, Va.
ELECTROPOLISHING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1978
Diane M. Cavagnaro Jul. 1978 115 p
(NTIS/PS-78/0711/8) Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

The Federally-funded citations contained within this bibliography cover most aspects of electropolishing, chemical polishing, and electrochemical machining. Some of the topics presented cover the processes involved, technology, materials that are used, storage decontamination, pollution control and the electrochemistry involved. GRA

N79-10253# National Bureau of Standards, Washington, D. C.
DIMENSIONS/NBS, VOLUME 62, NO. 5 Monthly Report
May 1978 33 p refs
(PB-283138/6; NBS-DIM-62-5) Avail: NTIS HC A03/MF A01 CSCL 05B

The monthly magazine features short summaries of major technical developments, highlights of work in progress, major speeches and statements by bureau management, and a listing of NBS publications. The table of contents for the current issue is: A scientist on capitol hill; Time and astronomy; Metric milk and bread--What sizes; NBS Research Associate Maurice Ducloux--The French connection; Group formed on electromagnetic interference; Gas flow measurement method uses cryogenic technique; Research begun on police radar and other speed measuring equipment; Strain tide spectroscopy. GRA

N79-10254# National Technical Information Service, Springfield, Va.
SURFACE EFFECT VEHICLES AND SURFACE EFFECT: GENERAL STUDIES, VOLUME 2: A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1972 - Jun. 1978
Guy E. Habercom, Jr. Aug. 1978 166 p Supersedes NTIS/PS-77/0648; NTIS/PS-76/0502; NTIS/PS-75/334
(NTIS/PS-78/0874/4; NTIS/PS-77/0648; NTIS/PS-76/0502; NTIS/PS-75/334) Avail: NTIS HC $28.00/MF $28.00 CSCL 01C

The design of surface effect vehicles, their utilization, and their aerodynamic characteristics are investigated. This updated bibliography contains 159 abstracts, 25 of which are new entries to the previous edition. GRA

N79-10255# National Technical Information Service, Springfield, Va.
CONCRETE (RIGID) HIGHWAY PAVEMENTS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1978 - Jul. 1978
Guy E. Habercom, Jr. Aug. 1978 236 p Supersedes NTIS/PS-77/0768; NTIS/PS-76/0691; NTIS/PS-75/679
(NTIS/PS-78/0868/6; NTIS/PS-77/0768; NTIS/PS-76/0691; NTIS/PS-75/679) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Concrete (rigid) pavement construction, construction materials, and mechanical properties of concrete pavements are evaluated in reports generated under research in highway engineering. GRA

N79-10256# National Technical Information Service, Springfield, Va.
FLEXIBLE HIGHWAY PAVEMENTS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Aug. 1978
Guy E. Habercom, Jr. Aug. 1978 243 p Supersedes NTIS/PS-77/0785; NTIS/PS-76/0675; NTIS/PS-75/674
(NTIS/PS-78/0867/8; NTIS/PS-77/0785; NTIS/PS-76/0675; NTIS/PS-75/674) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Flexible pavement construction, materials, and mechanical properties of flexible pavements are investigated. This updated bibliography contains 236 abstracts, 56 of which are new entries to the previous edition. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N79-10257 Oregon State Univ., Corvallis.
NONLOCAL ELECTROMAGNETIC THEORY OF FLUIDS WITH APPLICATIONS TO SURFACE WAVES IN A DIELECTRIC FLUID Ph.D. Thesis
Brian Michael McCay 1978 125 p
Avail: Univ. Microfilms Order No. 7815582

A nonlocal theory of fluids with electromagnetic constitution, capable of exhibiting electromagnetic interactions is developed. A generalized Clausian-Duhem thermodynamic inequality which encompasses nonlocal effects is derived and is applied to obtain specific forms of the constitutive equations, including the total electromagnetic moment, stress, and energy without any a priori assumption as their nature or form. Full thermodynamic restrictions and admissibility of the constitutive equations is investigated. A complete linear constitutive theory is also derived. The linear theory is used to analyze the problem of surface waves in a dielectric fluid medium. A theory of nonlocal polar electromagnetic fluids is also developed.
Dissert. Abstr.

N79-10258 Rice Univ., Houston, Tex.
ACCELERATION WAVES IN ELASTIC MEMBRANES Ph.D. Thesis
Julian John Pop 1978 191 p
Avail: Univ. Microfilms Order No. 7814794

Acceleration waves in isotropic, inhomogeneous, smooth, non-linear, elastic membranes were modelled as curves moving on a fixed surface in space, carrying with these a finite discontinuity in the acceleration field. The method employed in the analysis is the analogue of the singular surface theory used in continuum mechanics. The linear theory predicts that two types of (principal) acceleration waves, called shear and longitudinal waves, may propagate on a membrane and that their amplitude is governed by the same ordinary different equation. For the non-linear membrane a third principal wave, which has much the same character as a transverse wave on a string, is found. The amplitudes of principal transverse and shear waves are shown to be governed by the same partial differential equation; under special circumstances this equation has the same form as that governing the amplitudes in the linear theory. Dissert. Abstr.

N79-10259 California Inst. of Tech., Pasadena.
ELASTIC WAVE PROPAGATION IN IRREGULAR STRUCTURES Ph.D. Thesis
Tai-Lin Hong 1978 105 p
Avail: Univ. Microfilms Order No. 7815964

Refraction problems involving dipping layers are considered. The Cagniard-de Hoop method for flat structures is extended to such problems to evaluate the nongeometric effects of critical reflection and tunneling. Teleseismic problems involving curved interfaces are also considered. An approximation theory is developed to evaluate the effects of focusing and triplication due to the local curvature along such interfaces. An independent check on these approximation theories is performed by using finite element methods. The concepts, methods and results appear to be helpful in opening a new dimension in the fields of seismic modelling, inversion and prospecting. Dissert. Abstr.

N79-10260 Catholic Univ. of America, Washington, D. C.
A VARIATIONAL-FINITE ELEMENT FORMULATION FOR CALCULATING INDUCED ELECTROMAGNETIC FIELDS IN LOSSY DIELECTRIC MEDIA OF COMPLEX GEOMETRY Ph.D. Thesis
Stanley Morton Neuder 1978 143 p
Avail: Univ. Microfilms Order No. 7816886

Induced fields and absorbed power density are calculated in lossy dielectric media of irregular geometry and complex internal structure exposed to plane wave EM radiation. The minimizing function is approximated by a Ritz method or sum of piecewise linear polynomial functions, each defined over its respective finite element. A FORTRAN program was written based on this formulation and applied to both transverse magnetic (TM) and transverse electric (TE) scattering. A description of the computer programs and computational results of TM and TE scattering problems are presented. Also included is a discussion of extending the formalism to the three-dimensional case. Dissert. Abstr.

N79-10261 California Inst. of Tech., Pasadena.
ELECTROMAGNETIC WAVE GENERATION AND PROPAGATION IN GRAVITATIONAL FIELDS Ph.D. Thesis
Walter K. Delogi 1978 110 p
Avail: Univ. Microfilms Order No. 7815979

Feynman perturbation techniques were used to analyze electromagnetic wave generation and propagation. Differential cross sections for the scattering of plane electromagnetic waves by weakly gravitating and rotating bodies in the long-wavelength limit were calculated. The polarization of right (or left) circularly polarized electromagnetic waves was unaffected by the scattering process (i.e., helicity was conserved), and the two helicity states of the photon were scattered differently by a rotating body. This coupling between the photon helicity and the angular momentum of the scatterer also leads to a partial polarization of unpolarized incident light. The conversion of gravitational waves into electromagnetic waves (and vice versa) under the catalytic action of a static electromagnetic background field is also discussed. A model calculation of conversion in a Coulomb field is used to discuss the problems of calculating nongauge invariant transition amplitudes. Dissert. Abstr.

N79-10262* National Aeronautics and Space Administration. Pasadena Office, Calif.
AUTOMATIC COMMUNICATION SIGNAL MONITORING SYSTEM Patent
Albert J. Bernstein, inventor (to NASA) (JPL) Issued 3 Oct. 1978 8 p Sponsored by NASA
(NASA-Case-NPO-13941-1; US-Patent-4,118,666;
US-Patent-Appl-SN-774384; US-Patent-Class-324-77C;
US-Patent-Class-324-77B; US-Patent-Class-307-233R) Avail: US Patent Office CSCL 17B

A system is presented for automatic monitoring of a communication signal in the RF or IF spectrum utilizing a superheterodyne receiver technique with a VCO to select and sweep the frequency band of interest. A first memory is used to store one band sweep as a reference for continual comparison with subsequent band sweeps. Any deviation of a subsequent band sweep by more than a predetermined tolerance level produces an alarm signal which causes the band sweep data temporarily stored in one of two buffer memories to be transferred to long-term store while the other buffer memory is switched to its store mode to assume the task of temporarily storing subsequent band sweeps.
Official Gazette of the U.S. Patent Office

N79-10263* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
BIT ERROR RATE MEASUREMENT ABOVE AND BELOW BIT RATE TRACKING THRESHOLD Patent
Herbert S. Kobayaski, Joe Fowler (Lockheed Electronics Co., Houston, Tex.), and William Kurple, inventors (to NASA) Issued 11 Jul. 1978 7 p Filed 3 Feb. 1977 Supersedes N77-19290 (15 - 10, p 1297)
(NASA-Case-MSC-12743-1; US-Patent-4,100,531;
US-Patent-Appl-SN-765167; US-Patent-Class-340-146.1E;
US-Patent-Class-325-41; US-Patent-Class-340-146.1AX) Avail: US Patent Office CSCL 17B

Bit error rate is measured by sending a pseudo-random noise (PRN) code test signal simulating digital data through digital equipment to be tested. An incoming signal representing the response of the equipment being tested, together with any added noise, is received and tracked by being compared with a locally generated PRN code. Once the locally generated PRN code matches the incoming signal a tracking lock is obtained. The incoming signal is then integrated and compared bit-by-bit against the locally generated PRN code and differences between bits being compared are counted as bit errors.
Official Gazette of the U.S. Patent Office

N79-10264* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FM/CW RADAR SYSTEM Patent
Hans Brey (Sperry Rand Corp., Huntsville, Ala.) and Philio E. Geise, Jr., inventors (to NASA) (Sperry Rand Corp., Huntsville, Ala.) Issued 3 Oct. 1978 5 p Filed 8 Oct. 1976 Supersedes N76-33364 (14 - 24, p 3119) Sponsored by NASA
(NASA-Case-MFS-22234-1; US-Patent-4,118,701;

US-Patent-Appl-SN-730778; US-Patent-Class-343-6R; US-Patent-Class-343-9) Avail: US Patent Office CSCL 17I

An FM/CW radar system is presented with improved noise discrimination in which the received signal is multiplied by a sample of the transmitted signal, and the product signal is employed to deflect a laser beam as a function of frequency. The position of the beam is thus indicative of a discrete frequency, and it is detected by the frequency encoded positions of an array of photodiodes. The outputs of the photodiodes are scanned, then threshold detected, and used to obtain the range and velocity of a target.

Official Gazette of the U.S. Patent Office

N79-10265 California Univ., Santa Barbara.
SUPERCONDUCTING MICROWAVE ENERGY COMPRESSOR Ph.D. Thesis
Daniel Lloyd Birx 1978 108 p
Avail: Univ. Microfilms Order No. 7819132

A new technique for producing high power, phase coherent, pulses of microwaves is reported that uses a high Q superconducting resonator to accumulate microwave energy from a low power source over the long time period associated with the high Q of the resonator. This energy is then released in a short time period by the firing of a gas discharge. Because the microwave energy is stored over a much longer time period than is required to release it, the pulses have a much higher level than the sources while retaining pulse to pulse phase information supplied by the source. Dissert.Abstr.

N79-10266 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
IDENTIFICATION OF PERIODICALLY AMPLITUDE MODULATED TARGETS Ph.D. Thesis
Clayton Verne Stewart 1978 134 p
Avail: Univ. Microfilms Order No. 7818599

An algorithm that may be used for the classification of periodically amplitude modulated (PAM) targets is presented. The data base used to test the algorithm is derived from radar returns from vehicles moving at various velocities and aspect angles, but the techniques are applicable, as well, to other active wave devices such as sonar and laser. The received radar signal is considered to be a time series that is a function of target type, range, velocity, orientation and noise. Classification is implemented in the frequency domain; short-time spectra are computed using the Fast Fourier Transform (FFT). Features are extracted from the information bearing sidebands of the resulting spectra. The radar signatures are classified using both linear discriminant and nearest neighbor classifiers, and performance is presented for two, three, five, and six class cases using single and sequential looks. Dissert. Abstr.

N79-10267 California Inst. of Tech., Pasadena.
ELECTROMAGNETIC WAVE PROPAGATION IN ALMOST PERIODIC MEDIA Ph.D. Thesis
Alan Rolf Mickelson 1978 187 p
Avail: Univ. Microfilms Order No. 7817469

A solution obtained directly from Maxwell's equations is presented for propagation in almost periodic media. Techniques to evaluate this solution are developed. These techniques involve a generalization to almost periodic media of the Brillouin diagram of periodic media. The method of invariant imbedding is applied to the coupled mode equations which determine the Brillouin diagram for the purpose of transforming them to coupled Riccati equations. These coupled Riccati equations, when subjected to a single boundary condition, determine the solutions to both the periodic and almost periodic boundary value problems. These evaluation techniques are used to place in evidence similarities and differences of wave propagation in periodic and almost periodic media. Although the periodic and almost periodic theories agree in many cases of interest, there exist cases in which distinct differences appear. In cases of multitone perturbations, the almost periodic theory yields both simpler and more reasonable results than the periodic theory. Dissert. Abstr.

N79-10268 Massachusetts Univ., Amherst.
TIMING RECOVERY IN DATA COMMUNICATION Ph.D. Thesis
Martin Howard Meyers 1978 176 p
Avail: Univ. Microfilms Order No. 7818022

A number of different estimators are proposed. Data-aided estimators are derived which assume that the data sequence is known at the receiver. Nondata-aided estimators are derived which assume only a knowledge of the random data sequence. Arbitrary data correlation and intersymbol interference are included in the derivation of the estimators. The estimators are evaluated on the basis of their estimation error variances. The analysis allows comparison of the effects of excess bandwidth, different modulation schemes, data-aided versus nondata-aided recovery and joint estimation versus estimation of only one parameter. Optimum pulse shapes are found which minimize the variances of the estimators. A different type of estimator considered here is the so called pseudo-likelihood estimator. These estimators have surprisingly different performance than the true Maximum Likelihood estimators. Dissert. Abstr.

N79-10269*# National Aeronautics and Space Administration, Washington, D. C.
A SET OF SATELLITE EXPERIMENTS FOR STUDYING THE MAGNETOSPHERE-IONOSPHERE COMMUNICATIONS
K. I. Gringauz Oct. 1978 13 p Transl. into ENGLISH of "Kompleks Sputnikovykh Eksperimentov dlya Izucheniya Magnitosferno-Ionosfernykh Svyazey", Rept. PR-290 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1976 p 1-13 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75563; PR-290) Avail: NTIS HC A02/MF A01 CSCL 17B

Magnetospheric substorms are one of the basic problems in the physics of near earth space. They appear as magnetic and ionospheric perturbations, disturbances in radio communication, polar auroras and electromagnetic radiation in different frequency ranges. These phenomena were studied from single satellites. However, it is impossible to study these phenomena adequately without simultaneous measurements from at least two different positions with identical instruments. A suitable program can be developed based on the Interkosmos work using new achievements in electronics. G.Y.

N79-10270# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ON THE CAPACITY OF THE GAUSSIAN MULTIPLE-ACCESS CHANNEL WITH FEEDBACK
Aydano Barreto Carleial Aug. 1977 22 p refs
(INPE-1101-PE/076) Avail: NTIS HC A02/MF A01

An achievable rate region is obtained, for reliable communications over the Gaussian multiple-access channel with an ideal feedback link, using signal superposition that extends the previously known set of achievable rates. The region is larger than the capacity region of the same channel without feedback.

Author

N79-10271*# National Aeronautics and Space Administration. Pasadena Office, Calif.
MICROWAVE POWER TRANSMISSION BEAM SAFETY SYSTEM Patent Application
Richard M. Dickinson, inventor (to NASA) (JPL) Filed 16 Oct. 1978 19 p
(Contract NAS7-100)
(NASA-Case-NPO-14224-1; US-Patent-Appl-SN-951829) Avail: NTIS HC A02/MF A01 CSCL 20N

Electromagnetic, wireless power transmission systems, and more particular, apparatus and methods for controlling an electromagnetic transmission beam in accordance with power distribution profiles which are altered by an object entering the beam are presented. One application of the invention would be in transmitting high-power microwave energy from a spacecraft to a ground station, the beam being reshaped, dimmed, or doused in accordance with characteristics of objects entering the beam. The novelty of the invention lies in the use of a power profile sensing means to control an electromagnetic power beam by comparing power profiles experienced by radiation-receiving elements of the system and predetermined power profiles.NASA

N79-10272*# General Dynamics/Convair, San Diego, Calif.
ACHIEVABLE FLATNESS IN A LARGE MICROWAVE POWER ANTENNA STUDY Final Report

18 Aug. 1978 220 p
(Contract NAS9-15423)
(NASA-CR-151831; CASD-NAS-78-011) Avail: NTIS HC A10/MF A01 CSCL 20N

Achievable flatness for the microwave power transmission system antenna array was determined. Two configurations were analyzed in detail and evaluated as to their net potential misalignment. Manufacturing, joint slack, assembly, alignment and environmental aspects were considered. Approaches to each aspect were analyzed to minimize their contributions to distortions. B.B.

N79-10273*# City Coll. of the City Univ. of New York. Dept. of Electrical Engineering.
COMMUNICATION SYSTEM ANALYSIS FOR MANNED SPACE FLIGHT Technical Report, 1 Jun. 1977 - 1 Aug. 1978
Donald L. Schilling 1 Aug. 1978 23 p refs
(Contract NAS9-13940)
(NASA-CR-151844) Avail: NTIS HC A02/MF A01 CSCL 17B

The development of adaptive delta modulators capable of digitizing a video signal is summarized. The delta modulator encoder accepts a 4 MHz black and white composite video signal or a color video signal and encodes it into a stream of binary digits at a rate which can be adjusted from 8 Mb/s to 24 Mb/s. The output bit rate is determined by the user and alters the quality of the video picture. The digital signal is decoded using the adaptive delta modulator decoder to reconstruct the picture. G.Y.

N79-10274# Electromagnetic Compatibility Analysis Center, Annapolis, Md.
POTENTIAL INTERFERENCE TO 6 cm CONUS RADIO ASTRONOMY OBSERVATORIES FROM MLS C-BAND A/G DME Final Report
R. Rocca, Jr. (IIT Research Inst., Annapolis, Md.) Jun. 1978 70 p
(Contract DOT-FA70WAI-175; F19628-78-C-0006)
(AD-A057368; ECAC-PR-76-002; FAA-RD-77-111) Avail: NTIS HC A04/MF A01 CSCL 03/2

An electromagnetic compatibility analysis was done to determine the potential interference to CONUS radio astronomy observatories operating in the band 4.99-5.00 GHz, from the C-band DME (air-to-ground) associated with the time reference scanning beam microwave landing system, as a function of proposed MLS DME frequency assignment plans. A.R.H.

N79-10275# Army Missile Research and Development Command, Redstone Arsenal, Ala.
FOG AND HAZE IN EUROPE AND THEIR EFFECTS ON PERFORMANCE OF ELECTRO-OPTICAL SYSTEMS
Oskar M. Essenwanger and Dorothy A. Stewart Jun. 1978 15 p refs
(AD-A056431) Avail: NTIS HC A02/MF A01 CSCL 20/14

It is generally agreed that propagation of electromagnetic energy is affected by fog drops and water vapor, but climatological probabilities of attenuation do not exist except for the visible range which has wavelengths from about 0.4 to 0.7 micrometer. Unfortunately, attenuation in the visible portion of the spectrum does not uniquely determine attenuation of other wavelengths. The ratio of middle infrared attenuation to visible attenuation is determined mainly by the sizes of the drops in a fog because water vapor attenuation is small in the middle infrared and negligible in the visible. Water vapor is an important factor to be considered near one millimeter. GRA

N79-10276# Naval Ocean Systems Center, San Diego, Calif.
DETECTION OF SINUSOIDS IN WHITE NOISE BY ADAPTIVE LINEAR PREDICTION FILTERING Research and Development Report, Jan. - Oct. 1977
P. M. Reeves Nov. 1977 18 p refs
(XF11101100)
(AD-A056938; NOSC/TR-180) Avail: NTIS HC A02/MF A01 CSCL 09/3

This report describes four receivers for the detection of a sinusoid of known frequency but unknown phase in Gaussian white noise of known spectrum level. These are: the likelihood ratio detector, a processor employing incoherently averaged Discrete Fourier Transforms (DFTs) of the received signal, and two systems utilizing the frequency response of adaptive Linear Predictive Filters(LPFs). The LPF systems are described in detail, and an expression for optimal adaptive filter parameter selection is derived. Power curves for the four receivers are derived and compared. Results indicate that the adaptive methods are similar in performance to the incoherent DFT processor with one of the adaptive techniques offering a 1-db reduction in input signal-to-noise ratio (SNR) for operation at the same detection and false alarm probabilities. All three of these detectors require substantially higher SNRs than the likelihood ratio detector. Author (GRA)

N79-10277# IIT Research Inst., Annapolis, Md.
PROCEDURES FOR ANALYZING INTERFERENCE CAUSED BY SPREAD-SPECTRUM SIGNALS Final Report
Paul Newhouse Feb. 1978 190 p refs
(Contract F19628-78-C-0006; AF Proj. 649E)
(AD-A056911; ESD-TR-77-003) Avail: NTIS HC A09/MF A01 CSCL 09/3

A mathematical procedure is given for determining whether a spread-spectrum signal will cause an unacceptable interference condition in a victim receiver. The procedure involves calculating either the interference-to-noise ratio or the signal-to-interference ratio at the IF-amplifier output and comparing the ratio with an appropriate threshold value. The front end and IF amplifier of the victim receiver are treated as a bandpass filter and non linear processes are not considered. Author (GRA)

N79-10278# Lincoln Lab., Mass. Inst. of Tech., Lexington.
NETWORK SPEECH PROCESSING PROGRAM Semiannual Technical Summary, 1 Oct. 1977 - 31 Mar. 1978
Melvin A. Herlin and Bernard Gold 31 Mar. 1978 14 p
(Contract F19628-78-C-0002)
(AD-A056934; ESD-TR-78-76) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report covers the Voice/Data Integration Study and Demand-Assignment Multiple-Access Techniques. GRA

N79-10279# IIT Research Inst., Chicago, Ill.
TIME DOMAIN SOLUTIONS FOR ELECTROMAGNETIC COUPLING Final Technical Report, 26 Aug. 1977 - 26 Mar. 1978
Allen Taflove Jun. 1978 98 p refs
(Contract F30602-77-C-0163; AF Proj. 2338)
(AD-A056728; RADC-TR-78-142) Avail: NTIS HC A05/MF A01 CSCL 20/14

This research program investigated a new tool for the analysis of electro-magnetic coupling and shielding problems the finite-difference, time-domain FD- to solution of Maxwell's equations. The objective of the program was to evaluate the suitability of the FD- TD solution to determine the amount of electromagnetic coupling through an aperture into an enclosed conducting container. Two specific geometries were used for the evaluation. The first, a conducting cylinder with one open end. The other, the guidance section of a missile. Each of the two geometries was modeled to calculate the electro-magnetic field coupled into the structure and the results were compared to data previously obtained by other techniques. Author (GRA)

N79-10280# California Univ., Livermore. Lawrence Livermore Lab.
SOMINT: AN IMPROVED MODEL FOR STUDYING CONDUCTING OBJECTS NEAR LOSSY HALF-SPACES Final Report
J. N. Brittingham, E. K. Miller, and J. T. Okada 24 Feb. 1978 97 p refs
(Contract W-7405-eng-48)
(AD-A056732; UCRL-52423) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report summarizes the development of a moment-method numerical code to study wire antennas near lossy earth. The computation time of this code is greatly reduced by two new methods for evaluating the Sommerfeld integrals. In the evaluation of the integrals off the earth, a bivariate interpolation scheme on a prestored grid is shown to give very quick and accurate results. A new series solution is presented to evaluate the integral

for values near the interface. Test results of this program are given, along with extensive numerical data on vertical half-rhombic and sloping V antennas. Author (GRA)

N79-10281# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MULTIPLE BEAM FORMING NETWORKS
William C. Cummings 18 Apr. 1978 64 p refs
(Contract F19628-78-C-0002; AF Proj. 1227)
(AD-A056904; TN-11978-9; ESD-TR-78-70) Avail: NTIS HC A04/MF A01 CSCL 17/2

Lossless beam forming networks using phase shifters and quadrature couplers are described. A technique for using the Butler network with randomly spaced arrays is discussed. A synthesis procedure for networks with N-element arrays is described. A method of using these networks with planar arrays is discussed. A least mean square algorithm for the determination of a beam forming network for an arbitrary array and arbitrary beam directions is developed. Computed pattern data for two thinned random planar arrays is included. Author (GRA)

N79-10282# Rome Air Development Center, Griffiss AFB, N.Y.
A DIFFRACTION ANALYSIS OF THE ELLIPTICAL REFLECTOR
Ronald L. Fante Feb. 1978 40 p refs
(AD-A057207; RADC-TR-78-42) Avail: NTIS HC A03/MF A01 CSCL 20/14

A study has been made of the distribution of the electromagnetic fields diffracted by an elliptical reflector that is fed by a source at or near one of its two foci. For both the elliptic cylinder and the ellipsoid of revolution, the following calculations have been made: the magnitude of the fields near the foci, the size of the focal region, the displacement of the focal spot as a function of the source displacement, and application of the method of stationary phase in calculating the fields at points distant from either focus. Explicit results are presented for the fields as a function of the eccentricity of the ellipse and the angles subtended by the reflector edges. Author (GRA)

N79-10283# Army Missile Research and Development Command, Redstone Arsenal, Ala. High Energy Laser and Research Lab.
MILLIMETER AND SUBMILLIMETER WAVE SOURCES FOR RADAR APPLICATIONS
B. D. Guenther and R. T. Carruth 5 May 1978 53 p refs
(AD-A056768; DRDMI-H-78-6) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report presents the results of the evaluation of millimeter wave sources as candidates for components of a short range radar system. Author (GRA)

N79-10284# Naval Postgraduate School, Monterey, Calif.
NETWORK DESIGN FOR SURVIVABLE MILITARY SATELLITE COMMUNICATION M.S. Thesis
Kusnadi Djati Juwono Mar. 1978 55 p refs
(AD-A056396) Avail: NTIS HC A04/MF A01 CSCL 17/2

The survivability criterion of a communication network consisting of satellite and terrestrial radio links, is defined as a number 'm' of node-disjoint paths between any node and the ground satellite terminal; assuming that the terminals and the satellite links are highly invulnerable. In this thesis, an heuristic method for finding the required number and the locations of satellite ground terminals and designing a low cost terrestrial network satisfying a prespecified survivability criterion in an area with a specific geographical condition is presented. Author (GRA)

N79-10285# Ballistic Research Labs., Aberdeen Proving Ground, Md. Ballistics Research Lab.
EFFECTS OF NONEQUILIBRIUM PHENOMENA ON RADAR TRANSMISSION: NONEQUILIBRIUM IONIZATION
Joseph Lacetera and Gaelen R. Daum May 1978 22 p refs
(DA Proj. 8X3-63304-D-215)
(AD-A056652; AD-E430061; ARBRL-TR-02058) Avail: NTIS HC A02/MF A01 CSCL 18/3

An assessment has been made of the LTE (Local Thermodynamic Equilibrium) approximation of the chemical kinetics of nuclear fireballs. The results are described in terms of the effect of the nonequilibrium fireball upon the radiant flux incident on a radar path. Author (GRA)

N79-10286# State Univ. of New York at Buffalo, Amherst. Dept. of Electrical Engineering.
TEST VALIDATION OF EQUIVALENT FULL LOAD IDLE CHANNEL NOISE CONCEPT
R. L. Feik Griffiss AFB, N. Y. RADC Jun. 1978 101 p
(Contract F30602-75-C-0122)
(AD-A056587; RR-78-3; RADC-TR-78-125) Avail: NTIS HC A06/MF A01 CSCL 17/2

During the efforts to analyze the Technical Evaluation Program data, considerable effort was spent to devise an effective method to prove TEP data accuracy and correlation. During this work, a new concept emerged. This approach permits accurate determination of interrelationships among baseband loading, idle channel noise, and noise power ratio. The application of this concept, named Signal to Noise Noise Power Ratio (SNNPR) permits the cross correlation of TEP data gathered at any fortuitous alignment condition, and also allows the correction of 'poor data' if the bulk of the data is acceptable. The data used as a basis for the new correlation technique was originally gathered empirically but proved to be accurate when tested on measurements from a number of older TEP reports. DCA authorized a short field test program at Ft. Huachuca, Arizona, supported by the Army to prove the concept. This report covers the approach, the specific measurements on the radios under several degradation conditions, and the end to end test to prove the concept validity and accuracy. The overall theory of the concept is discussed. A general SNNPR curve is constructed based upon theoretical data only that is universally applicable to all FDM-FM radio links. The accuracy of the approach is examined using a number of TEP link reports. GRA

N79-10287# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
THE MECHANISM OF CORROSION INHIBITION BY DINONYLNAPHTHALENESULFONATES
Paul J. Kennedy Jun. 1978 12 p refs
(AD-A056454) Avail: NTIS HC A02/MF A01 CSCL 17/9

Operability of combat and support equipment can be seriously compromised by rusting of power train components. As a preventative measure, most lubricants in the Army Supply System are rust inhibited. Sulfonates, such as the petroleum sulfonates and salts of dinonylnaphthalenesulfonic acid, have proven to be effective rust preventatives for Army lubricants, however, their use is limited due to their high temperature instability and viscosity. New rust inhibitor systems are needed for formulation into a variety of fluids such as turbine engine oils, aircraft hydraulic fluids and the newer synthetic nonhydrocarbon fluids. A basic understanding of the rust inhibition mechanism is needed in order to accomplish this task and to keep pace with potential rust problems associated with advanced Army systems. GRA

N79-10288# Army Foreign Science and Technology Center, Charlottesville, Va.
THE STRANGE BEHAVIOR OF ELECTROMAGNETIC WAVES IN CONDUCTING MAGNETO-DIELECTRIC MEDIA
Orville R. Harris Jun. 1978 15 p refs
(AD-A056443) Avail: NTIS HC A02/MF A01 CSCL 20/4

Reflection and transmission of electromagnetic waves at boundaries between dielectric media, and reflection at highly conducting boundaries have been treated extensively in the literature for years. Usually approximations have been made to fit the special case under discussion. When dealing with good dielectrics, the conductivity is usually neglected and for highly conducting materials the dielectric constant is neglected. Almost always, the permeability is considered to be equal to that of free space. Between these limiting cases, there are a host of materials in which all three constitutive parameters, permeability, permittivity, and conductivity should be considered. GRA

N79-10289# Mississippi State Univ., Mississippi State. Dept. of Electrical Engineering.
COMPARISON OF REAL TIME AND FFT PROCESSING ALGORITHMS FOR ACOUSTIC DATA Final Report, 25 Sep. 1977 - 24 Jun. 1978
Frank M. Ingels 30 May 1978 58 p refs

(Grant DAAG29-77-G-0230)
(AD-A056774; MSSU-EIRS-EE-78-4; ARO-15462.1-R-EL)
Avail: NTIS HC A04/MF A01 CSCL 09/3

This report presents the numerical results and conclusions drawn from a computer simulation of two processing algorithms for acoustical data. The performance of the two algorithms, a real time processor (RTP) and a frequency domain processor (FFTP) is compared by the simulation and conclusions are drawn as to the relative merits of the two processing methods under various conditions of noise. Author (GRA)

N79-10290# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE QUASI-NEAR FIELDS ABOVE A CONDUCTING SLAB
Peter R. Bannister 24 Apr. 1978 25 p refs
(Contract N00017-12-C-4401)
(AD-A056797; NUSC-TR-5805) Avail: NTIS
HC A02/MF A01 CSCL 20/3

Approximate expressions for the quasi-near fields in air produced by electric and magnetic antennas located within a conducting slab have been obtained by applying the quasi-static and quasi-near approximations to the basic Sommerfeld integrals. The resulting expressions are particularly applicable to subsurface to air propagation for the shallow sea case. Author (GRA)

N79-10291# Control Data Corp., Minneapolis, Minn.
DIGITAL MODULAR CHANGE DETECTOR Final Technical Report, 9 Mar. 1973 - Jan. 1978
R. Denny, M. Baynes, W. McLure, V. Froehlich, and R. Rigles May 1978 199 p
(Contract F30602-73-C-0141)
(AD-A056953; RADC-TR-78-104) Avail: NTIS
HC A09/MF A01 CSCL 17/9

This report describes the development of a Digital Modular Change Detector (DMCD). One method of Interpretation of Synthetic Aperture Side-Looking Airborne Radar (SLAR) images is based on the comparative analysis of two images of the same area exposed at different times to detect any differences or changes in detail that have occurred during the interim period. Recent improvements in SLAR technology have advanced the operational state-of-the-art in collection system where radar imaged data can be obtained over wide swath widths at rates of many thousand of square nautical miles per hour. To exploit intelligence in a timely manner from this data requires on-line automated processing, screening, and display of changes pertinent to an interpreter. This program designed, fabricated, tested and demonstrated a digital modular change detection system for SLAR imagery. The modular approach uses a programmable module, provides the capability for system growth potential and adaptability to meet new Air Force SLAR imagery processing requirements. Author (GRA)

N79-10292# Kentucky Univ., Lexington.
A SUMMARY OF REQUIRED INPUT PARAMETERS FOR EMITTER MODELS IN IEMCAP Final Technical Report
Clayton R. Paul and Donald D. Weiner (Syracuse Univ.) Jun. 1978 51 p
(Contract F30602-75-C-0118)
(AD-A056805; RADC-TR-78-140) Avail: NTIS
HC A04/MF A01 CSCL 20/14

The Intrasystem Electromagnetic Compatibility Analysis Program (IEMCAP) requires the inputting of various parameters to describe the emitter ports: emission spectra. This information is contained in the IEMCAP User's Manual (RADC-TR-74-342) but is not presented in a very concise manner. This report has summarized the required parameters and their measurement units. Along with this information the form of the power spectral density and suggested frequency table input values, to adequately represent the spectrum, are presented. This information will simplify the effort needed to model an emitter port.
Author (GRA)

N79-10293# CNR, Inc., Needham, Mass.
WIDEBAND LINE-OF-SIGHT CHANNEL SIMULATOR Final Technical Report, Apr. 1975 - Dec. 1977
Phillip A. Bello, David Goldfein, K. Paul Jauniskis, and Anthony Lavely Jun. 1978 117 p
(Contract F30602-75-C-0242)
(AD-A056374; RADC-TR-78-118) Avail: NTIS
HC A06/MF A01 CSCL 20/14

This report describes the theoretical background, methods of implementation, and utility of a multi-purpose wideband LOS (line-of-sight) channel simulation system developed by CNR, Inc. for Rome Air Development Center as a means for evaluating wideband digital modems. The system provides both a channel probing/channel playback capability and a synthetic stochastic channel simulation. Propagation media effects simulated, include both multipath due to refractive anomalies (refractive multipath) and scattering off the surface (surface multipath). The types of LOS channels handled by the system include airplane-airplane, ground-airplane, ground-ground, and airplane-satellite. In addition the simulator allows the introduction of controlled amounts o nonlinearity, phase jitter, and frequency offset. The simulato operates at selectable IF frequencies of 70, 300, or 700 MHz At the two high IF frequencies, signal bandwidths up to 10(MHz may be accommodated, while at 70 MHz, bandwidths up to 25 MHz may be handled. Author (GRA

N79-10294# SRI International Corp., Menlo Park, Calif.
ALTAIR: AN INCOHERENT SCATTER RADAR FOR EQUATORIAL SPREAD-F STUDIES Topical Report, 1 Jun 1977 - 1 Jan. 1978
R. T. Tsunoda, M. J. Baron, and J. Owen Jan. 1978 45 p refs
(Contract DNA001-77-C-0220)
(AD-A056386; AD-E300266; DNA-4538T) Avail: NTIS
HC A03/MF A01 CSCL 17/9

In this report, we present preliminary results obtained from data collected with ALTAIR, a high-power VHF/UHF radar, during the Wideband Equatorial Program. The Wideband Equatoria Program is a coordinated field program sponsored by the Defense Nuclear Agency (DNA) to study the physical processes underlying the production of intense field-aligned irregularities and the effects of those irregularities on satellite communication channels tha operate in the gigahertz frequency range. This radar is sensitive enough for incoherent-scatter measurements as well as being capable of spatially mapping E and F region irregularities as a function of time. With data collected from the operation of ALTAIR in a sector scan mode it is possible to determine the spatia distribution of 1-m spread-F irregularities and their dynamics and to relate them to the parameters of the background equatoria ionosphere. These relationships provide a means of critically evaluating proposed source mechanisms of equatorial spread-F. GRA

N79-10295# National Technical Information Service, Springfield Va.
SINGLE SIDEBAND COMMUNICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1978
William E. Reed Jul. 1978 161 p Supersedes NTIS/PS-77/0594; NTIS/PS-76/0547; NTIS/PS-75/449
(NTIS/PS-78/0733/2; NTIS/PS-77/0594; NTIS/PS-76/0547; NTIS/PS-75/449) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

The bibliography contains Federally-sponsored research on single sideband communication equipment and systems. Reports on the design, development, and operation are presented. Studies on single sideband transmission, modulation, and signal processing are included. GRA

N79-10296# National Technical Information Service, Springfield, Va.
PORTABLE RADIO EQUIPMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978
William E. Reed Aug. 1978 147 p Supersedes NTIS/PS-77/0714; NTIS/PS-76/0615; NTIS/PS-75/547
(NTIS/PS-78/0795/1; NTIS/PS-77/0714; NTIS/PS-76/0615; NTIS/PS-75/547) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

The bibliography cites research on portable transmitters, receivers, antennas, power sources, and components. Radio transmission from portable radio equipment is included. This updated bibliography contains 140 abstracts, 5 of which are new entries to the previous edition. GRA

N79-10297# National Technical Information Service, Springfield, Va.

LAND MOBILE COMMUNICATIONS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978

William E. Reed Aug. 1978 165 p Supersedes NTIS/PS-77/0715; NTIS/PS-76/0616; NTIS/PS-75/546

(NTIS/PS-78/0794/4; NTIS/PS-77/0715; NTIS/PS-76/0616; NTIS/PS-75/546) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

The cited research reports include studies on public policy, frequency allocation and management, licensee data, satellite relays, wave propagation, and equipment. This updated bibliography contains 158 abstracts, 16 of which are new entries to the previous edition. GRA

N79-10298# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.

ATMOSPHERIC PROPAGATION EQUATIONS USED IN THE NBS EARTH TERMINAL MEASUREMENT SYSTEM

W. C. Daywitt Apr. 1978 56 p refs

(PB-282505/7; NBSIR-78-883) Avail: NTIS HC A03/MF A01 CSCL 17B

A derivation of equations for approximating the atmospheric refraction angle and transmission coefficient is outlined. The approximations apply in the 1 GHz to 10 GHz frequency range and are accompanied by systematic error estimates. They are used in the NBS Earth Terminal Measurement System for quasi-real-time calculations concerned with the measurement of earth-terminal gain-to-noise-temperature ratio (G/T), satellite effective isotropic radiated power (EIRP), and downlink carrier-to-noise density ratio (C/kT). GRA

N79-10299# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

ASPECTS OF ELECTROMAGNETIC WAVE SCATTERING IN RADIO COMMUNICATIONS

A. N. Ince, ed. (SHAPE Tech. Centre, The Hague) Sep. 1978 529 p refs partly in ENGLISH and FRENCH Presented at the Electromagnetic Wave Propagation Panel Symp., Cambridge, Mass., 3-7 Oct. 1977

(AGARD-CP-244; ISBN-92-835-0219-1) Avail: NTIS HC A23/MF A01

The proceedings deal with the theory of scattering and reflection in the troposphere, the ionosphere, from meteor trails, and also scattering from ground environmental hazards such as hills, trees, and buildings. In the propagation aspect, the prediction of long and short term signal characteristics and the modeling and simulation of radio channels are included using scatter mode of propagation. The proceedings also cover transmission and signal processing techniques for effective communications over such channels. For individual titles, see N79-10300 through N79-10333.

N79-10300# Royal Norwegian Council for Scientific and Industrial Research, Kjeller. Remote Sensing Technology Programme.

SCATTERING MECHANISMS AND CHANNEL CHARACTERIZATION IN RELATION TO BROAD BAND RADIO COMMUNICATION SYSTEMS

Dag T. Gjessing *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 15 p refs (For primary document see N79-10299 01-32)

Avail: NTIS HC A23/MF A01

Many modern communication systems, such as systems making use of the spread spectrum mode, large synchronous time division multiplexing, and package switching in data transmission networks involving computers, were very sensitive to certain properties of the propagation medium (bandwidth, delay spectrum width, etc). With these communication systems, some of the more important channel characterization parameters for circuits involving scattering by inhomogeneities in the tropospheric refractive index structure, by topographic irregularities or by rain were reviewed. Some of the theoretical results, which were derived from first principles, were compared with experimental findings. J.A.M.

N79-10301# Brunel Technical Coll., Bristol (England). Dept. of Marine Electronics.

ELECTRO-MAGNETIC WAVE PROPAGATION IN AN INHOMOGENEOUS MEDIUM: A LABORATORY STUDY

W. G. Burrows *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 23 p refs (For primary document see N79-10299 01-32)

Avail: NTIS HC A23/MF A01

A physical modelling technique was used as an aid in the study of radio wave propagation in the troposphere. The basic technique employed an optical model, scaled and constructed to represent a full size tropospheric radio system, where a coherent light beam was propagated through an inhomogeneous gaseous medium whose structures and properties might be considered to represent the real atmosphere. The model was used, concurrently with the full scale system, to conduct a number of investigations in an attempt to establish the significance of the time varying refractive index properties of the medium in relation to changes in the structure of the propagated beam at distances from the source. Some of the many simple experimental studies are summarized to illustrate the value of the technique. These results when compared with those obtained from the full scale system gave rise to the conclusion that the primary mechanisms of transhorizon propagation were associated with atmospheric structures in the lower region of the troposphere. J.A.M.

N79-10302# Saarland Univ., Saarbrucken (West Germany).

TROPOSPHERIC REFLECTION OF DIFFERENTLY POLARIZED TRANSIENT SIGNALS

K. J. Langenberg *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 12 p refs (For primary document see N79-10299 01-32)

Avail: NTIS HC A23/MF A01

The evaporation duct model was used, consisting of a discontinuous drop of the otherwise constant relative permittivity at the upper duct boundary. The earth was assumed to be a perfect conductor and ideally plane. The electrical field strength was determined at a fixed point within the duct layer, having chosen a certain polarization of the primary source, whose moment was allowed to vary arbitrarily in time. The solution method was essentially based on the application of two functional transforms and Cagniard's method for their inversion. J.A.M.

N79-10303# Colorado Univ., Boulder.

TROPOSCATTER APERTURE-MEDIUM COUPLING LOSS

C. Lewin *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 6 p refs (For primary document see N79-10299 01-32)

Avail: NTIS HC A23/MF A01

Two basically different descriptions were given as to the cause of aperture coupling loss in tropospheric scatter systems: nonplanar wavefront due to atmospheric irregularities; and a geometric effect due to the decrease of scattering properties with height within the common volume of the beams of the transmitter and receiver antennas. The irregular wavefront explanation was examined and related to height-diversity concepts, and it was shown that the effect was determined by the angular spectrum of incoming rays; performance was related to the angle range and beam width. In the explanation via the geometric effect, it was shown that increasing the antenna gain increased the on-axis power but decreased the angular range over which energy was received. The reduction in effective angular range was due to the same phenomenon as that giving rise to the loss due to the irregular phase fronts. It was concluded that the two explanations really reduce to one and the same. J.A.M.

N79-10304# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).

STATISTICS OF TROPOSCATTER CHANNELS WITH RESPECT TO THE APPLICATIONS OF ADAPTIVE EQUALIZING TECHNIQUES

F. Schmitt *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 15 p refs (For primary document see N79-10299 01-32)

Avail: NTIS HC A23/MF A01

Higher coherent bandwidth requirements for troposcatter communication channels may create serious problems due to the dispersion characteristics of troposcatter channels. The multipath structure of such a channel is time variant. Introduction

of digital PCM techniques may allow for processing schemes which result in adaptively equalizing the transmission channel. These processing schemes were based on the troposcatter channel characteristics. The experiments were made at a frequency of 0.9 GHz with a bandwidth of 10 MHz. The impulse response functions were measured at a rate of 10 per sec for one minute, followed by intermodulation measurements for one minute and then starting the cycle again. J.A.M.

N79-10305# General Electric Co., Syracuse, N.Y.
HF SCATTER FROM OVERDENSE METEOR TRAILS
George H. Millman *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 14 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

The characteristics of HF radar reflections from overdense meteor ionization trails, having line densities greater than 10 to the 14th power electrons/m, are discussed. Theoretical estimates were made of the radar cross sectional area, time duration, and the Doppler frequency shift of meteor echoes. Utilizing experimental meteor data recorded at 32 MHz by Greenhow and Watkins (1964), extrapolations were made of the statistical variations of the cross sectional area, the echo duration, and the meteor echo rate for frequencies in the 6 MHz to 40 MHz band. J.A.M.

N79-10306# Raytheon Co., Wayland, Mass.
TIME AND FREQUENCY SPREAD IN METEOR BURST PROPAGATION PATHS
M. D. Grossi and A. Javed (Bell-Northern Res. Ltd., Ottawa) *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. 1978 11 p refs (For primary document see N79-10299 01-32)
(Grant NOAA-04-4-158-16)
Avail: NTIS HC A23/MF A01

Meteor burst propagation provided an intriguing medium for over-the-horizon intermittent communications at VHF, but was characterized by several undesirable properties that have severely limited, thus far, its application to links of practical relevance. This channel, in addition to being intermittent, was also characterized by time variable multipath spread and Doppler spread. Typically, in VHF links 100 to 1500 km long, the gain decreased by about 10 db after a few seconds from trail formation, the value of the multipath spread rose to a few microseconds, while Doppler spread was at most a few hertz. Analog techniques did not prove fully suitable in the past for coping with this type of channel, and very few applications of meteor burst links were known to have reached practical implementation and operational use. J.A.M.

N79-10307# Air Force Geophysics Lab., Hanscom AFB, Mass.
THE EVOLUTION OF SCATTERING EQUATORIAL F-REGION IRREGULARITIES AND RESULTANT EFFECTS ON TRANS-IONOSPHERIC RADIO WAVES
Herbert E. Whitney, Jules Aarons, Jurgen Buchau, Edward J. Weber, and J. P. McClure (Texas Univ. at Dallas) *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 11 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

Results from a series of ground and airborne experiments are presented which describe spatial and temporal characteristics of equatorial F-region irregularities and the effect of these irregularities on transionospheric radio propagation. The experiments included UHF amplitude scintillation measurements from the WIDEBAND, MARISAT, and LES-9 satellites, and simultaneous ionospheric measurements from the AFGL Airborne Ionospheric Observatory and the Jicamarca Radar Observatory in Peru. The results indicated a highly localized generation of the irregularities such that individual patches consisted of dense irregularities of the order of 10 - 100% of the ambient electron density. The extent of each patch is of the order of 50-400 km east-west and at times greater than 1200 km in the north-south direction. Within these regions small scale irregularities from several kilometers to as small as 3 meters often existed. Once the patches were generated, they moved predominantly eastward with initial velocities of 50-150 meters per second. J.A.M.

N79-10308# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Electrical Engineering.
PULSE DELAY AND PULSE DISTORTION BY RANDOM SCATTERING IN THE IONOSPHERE
K. C. Yeh and C. H. Liu *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 7 p refs (For primary document see N79-10299 01-32)
(Grant DAAG29-76-G-0286)
Avail: NTIS HC A23/MF A01

The effects of the random scattering on the pulse delay and the pulse width were studied; this problem was mathematically formulated and solved. All multiple scattering effects were taken into account except the backscattering. The solutions are given in terms of many parameters which can be classified into three kinds: signal parameters, ionospheric parameters, and irregularity parameters. It was found that under certain conditions effects caused by random scattering can be more important than those caused by dispersion. J.A.M.

N79-10309# Naval Ocean Systems Center, San Diego, Calif.
THE ATMOSPHERIC SCATTER CHANNEL FOR OPTICAL COMMUNICATIONS OVER-THE-HORIZON
G. C. Mooradian, M. Geller, R. A. Krautwald, and D. Stephens *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 11 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

Measurements of the properties of an over-the-horizon optical propagation channel by scattering from normal marine atmospheric aerosols were made. The signal loss of a 40 mile path for wavelengths in the blue-green was nominally -100 db when the atmospheric visibility was greater than 10 miles. This loss decreased by approximately 20 db for the near infrared at 1.06 micron. When atmospheric ducting occurred, the path loss for both wavelength regions decreased by 20 db with accompanying severe scintillation. The apparent angular source size was small, less than 10 milliradians and there was no evidence of pulse dispersion for the 20 ns transmitted pulses for the 40 mile path. The scattered beam was sharply peaked in the forward direction. A model that was developed is in reasonable agreement with the data. J.A.M.

N79-10310# CNR, Inc., Needham, Mass.
RELATIONSHIP BETWEEN MODEM DEVELOPMENT AND CHANNEL CHARACTERIZATION
Phillip A. Bello *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 3 p (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

The most effective approach to the development of optimum modulation and demodulation techniques for a specific class of channels involved a sequence of steps. These steps included the measurement and modeling of channel characteristics to provide the basis for optimum modem design concepts and the utilization of channel simulators for the development, acceptance testing, and comparative evaluation of implemented modems prior to field testing. J.A.M.

N79-10311# CNR, Inc., Needham, Mass.
WIDEBAND LINE-OF-SIGHT CHANNEL SIMULATION SYSTEM
Phillip A. Bello and H. David Goldfein *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 14 p refs (For primary document see N79-10299 01-32)
(Contract F30602-75-C-0242)
Avail: NTIS HC A23/MF A01

The theoretical background, methods of implementation, and utility of a multipurpose wideband LOS (line-of-sight) channel simulation system is described as a means for checking out wideband digital modems. The system provided both a channel probing/channel playback capability and a synthetic stochastic channel simulation. Simulated propagation media effects included both multipath due to refractive anomalies (refractive multipath) and scattering off the surface (surface multipath). The types of LOS channels handled by the system included airplane-airplane, ground-airplane, ground-ground, and airplane-satellite. In addition, the simulator allowed the introduction of controlled amounts of nonlinearity, phase jitter, and frequency offset. The

simulator operated at selectable IF frequencies of 70, 300, or 700 MHz. At the two higher IF frequencies, signal bandwidths up to 100 MHz may be accommodated, while at 70 MHz, bandwidths up to 25 MHz may be handled. J.A.M.

N79-10312# Laboratoire d'Etude des Transmissions Ionospheriques, Cachan (France).

ELECTROMAGNETIC SOUNDING TECHNIQUE USING SPECTRAL AND SPATIAL SAMPLING OF THE RECEPTION SIGNALS, APPLICATION TO THE STUDY OF INHOMOGENEITIES IN IONOSPHERIC PLASMA

C. Goutelard, J. L. Caratori, and A. Joisel *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 22 p refs In FRENCH; ENGLISH summary (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

The study of diffusion properties of ionospheric plasma was connected to inhomogeneities of free electrons density. The inhomogeneous studies were carried out by different methods, using very sensitive measuring systems. The backscatter sounding method necessitated important installations. A sounding station, using this principle, was constructed. Very accurate and precise measurements were readily obtained. Frequency resolutions better than 0,01 Hz are usually reached although measurements points are separated by only 0,05 s. Spatial resolutions were only limited by technological aspects. This technique was used in backscatter ionospheric soundings and allowed low value inhomogeneities in ionospheric plasma to be revealed, as well as certain brief local changes such as ionized meteor trails. J.A.M.

N79-10313# Laboratoire d'Etude des Transmissions Ionospheriques, Cachan (France).

APPLICATION OF BACKSCATTER TECHNIQUE TO IONOSPHERIC SHORT TERM PREDICTIONS

C. Goutelard, J. L. Caratori, J. L. Coatanhay, and R. Rolland *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 16 p refs In FRENCH; ENGLISH summary (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

A forecasting method based upon the use of the spectrals analysis of backscatter echoes and on the inversion of backscatter ionograms is described. The inversion program, which made use of regression curves can easily be processed using a small computer. The exploitation of the spectrals analysis of backscatter echoes allowed instantaneous measurement of dynamic parameters of the ionized layers and brought about a considerable increase in the probability of a link being well established. Experimental results carried out on real cases show the validity of the method. J.A.M.

N79-10314# Saarland Univ., Saarbrucken (West Germany).

CALCULATION OF THE SCATTERING CROSS-SECTION OF PERFECTLY CONDUCTING OR DIELECTRIC BODIES BY NUMERICAL OR PERTURBATIONAL METHODS

K.-D. Becker *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 13 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

For the calculation of the scattering cross section of perfectly conducting or dielectric cylinders of rough surfaces, two methods were used: a numerical method, based on integral equation formalism, and a perturbational method. The validity of the results based on these methods was examined in their dependence on selected characteristic parameters. Also, the influence of these characteristic parameters on the far field cross section was studied. J.A.M.

N79-10315# Kansas Univ., Lawrence. Remote Sensing Lab.

A SCATTER MODEL FOR LEAFY VEGETATION

A. K. Fung and F. T. Ulaby *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 10 p refs (For primary document see N79-10299 01-32)
(Grant NSF ENG-75-03220; DAAG29-77-G-0075)
Avail: NTIS HC A23/MF A01

A model for vegetation scatter was developed, using the first order renormalization method. The vegetated medium was taken to be an inhomogeneous medium characterized by a random permittivity function with a cylindrically symmetric, fast decaying correlation function. The permittivity of the vegetation (taken to be a combination of water and some solid material) was estimated by mixing formula after de Loor (1968) and the permittivity of the vegetated medium (taken to be a combination of vegetation and air) was estimated. The backscattering coefficient from such a model was computed as a function of the incidence angle, frequency, and the moisture content of the vegetation. Comparisons were made with measured data from soybeans, alfalfa, and corn. J.A.M.

N79-10316# British Aircraft Corp., Filton (England). Guided Weapons Div.

VHF PROPAGATION PREDICTION WITH PATH PROFILE METHODS

B. K. Lee *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 11 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

Propagation prediction models applicable to VHF military type links in West Germany were derived. These related to a static base station located to give good area coverage. The initial stages of the work involved the measurement of propagation losses (and local signal variations) for 830 paths at 3 frequencies, and also the construction of a digitized topographic data base for the area considered. The latter enabled two dimensional path profiles with associated surface features (such as trees and buildings) to be rapidly produced between any two points within the data base area. The measured data were analyzed in conjunction with the associated path profiles to produce prediction models for both the median propagation loss and the local signal variations as functions of the path profile. The standard deviation of prediction error for the former was 7.3 db, while the average standard deviation for the signal distributions for the latter was 2.5 db. J.A.M.

N79-10317# Research Inst. of National Defence, Stockholm (Sweden).

MULTIPATH CHARACTERISTICS AT UHF IN RURAL IRREGULAR TERRAIN

Lars Ladell *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 12 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

Extensive measurements were carried out in order to get a better knowledge concerning multipath characteristics in rural irregular terrain. These measurements were then used in a comparison with two different theoretical models, which were developed to find out the behavior of multipath propagation in different kinds of terrain. In a deterministic theoretical model, the field strength of a delayed wave component was calculated, assuming a given vertical reflection obstacle oriented for optimum reflection. From this model, the effects on multipath propagation by changing polarization, frequency or antenna height, may be assessed. By means of a Monte Carlo technique this deterministic model together with a statistical description of terrain characteristics were utilized to create a stochastic model. It was used for risk analysis of multipath propagation effects in different kinds of irregular terrain. J.A.M.

N79-10318# Shape Technical Center, The Hague (Netherlands).

INTERCEPTION OF SIGNALS TRANSMITTED VIA METEOR TRAILS

A. N. Ince *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 13 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

In order to test the vulnerability of meteor-burst signals to interception and jamming, a 1000 km circuit between La Crau, near Toulon, France, and Staalduinen near The Hague, Netherlands, was monitored at five different locations. These were Harrogate in the UK, Saclay near Paris, Breisach near Freiburg, Santa Marinella near Rome, and Noordwijk, some 35 km from the terminal at Staalduinen. It was found that at Noordwijk, the same signal bursts were received as at the northern terminal 35 km away, and interception was practically total. At the other four locations, interception was mainly due to the simultaneous occurrence of two meteor trails reflecting waves in different directions. The amount of information intercepted was on the

average between 3 percent and 16 percent, but could occasionally be 100 percent due to sporadic-E layer reflections. However, the experiments used a frequency of 36 MHz; by operating at 70 MHz or higher interception due to abnormal ionospheric propagation, conditions could be virtually eliminated. J.A.M.

N79-10319# Institute for Telecommunication Sciences, Boulder, Colo. Policy Res. Div.
TROPOSPHERIC STRATIFICATION AND ANOMALOUS PROPAGATION
Harold T. Dougherty and Burgette A. Hart *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 9 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

The progress to date was summarized for predicting the enhanced fields that were encountered in a stratified atmosphere. The ducting conditions associated with supercritical refractivity gradients both aloft and at or near the surface were considered. As a basis for estimating the likelihood of these supportive conditions, the available information was surveyed. It was suggested that the access to computers and the availability of historical radiosonde data be exploited to map the pertinent characteristics of tropospheric layers on a worldwide basis to meet the interference prediction requirements of the telecommunications regulatory agencies. J.A.M.

N79-10320# Shape Technical Center, The Hague (Netherlands).
A REVIEW OF SCATTER COMMUNICATIONS
A. N. Ince, I. M. Vogt, and H. P. Williams *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 31 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

Six distinct forms of scatter communication were reviewed, namely ionoscatter, meteorscatter, field aligned scatter, troposcatter, chaff or needles, and a short range scatter from using ultraviolet radiation. A summary was provided in the form of a figure giving typical values of the frequencies and distances involved, together with the multipath and frequency spreads and typical scatter losses. Each type of scatter communication is discussed briefly, though because of the greater importance of troposcatter systems this form is dealt with at some length. It was pointed out that troposcatter predictions were still subject to errors in the path loss of 10 db or more, and that a better knowledge is required of the effect of climatic conditions. A neglected type of scatter communication was meteor burst which offers a simple solution to the transmission of a few telegraph channels for distances of up to 2000 km. J.A.M.

N79-10321# Defense Communications Engineering Center, Reston, Va.
DESIGN CONSIDERATIONS FOR DIGITAL TROPOSCATTER COMMUNICATIONS SYSTEMS
J. L. Osterholz *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 15 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

The performance of digitized voice channels under fading conditions was measurably different than the performance of conventional analog voice channels under the same conditions. Therefore the applicability of existing analog transmission link and system design criteria to the design of a digital transmission system was negligible. Performance criteria were proposed for digitized voice channels which more accurately reflect the expected temporal distribution of channel outages given the fading statistics of the troposcatter channel. Measured data is presented along with a digital troposcatter channel model which effectively bounds voice channel outage statistics on digital troposcatter links and relates these statistics to link design parameters such as link signal to noise ratio, multipath dispersion, and diversity configuration. J.A.M.

N79-10322# Marconi Communication Systems Ltd., Chelmsford (England).
LEVEL CONTROL IN TROPOSPHERIC SCATTER SYSTEMS
B. S. Skingley *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 8 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

The methods used to implement the various level control techniques are described, along with design criteria for setting various critical parameters and for establishing specific approaches. It was noted that receive-level-control alone was sufficient to enable the filters to be effective in minimizing interference into any given link from other systems. Temperature control was also required to minimize interference. A method is described whereby both systems can be implemented to gain the advantages of both. J.A.M.

N79-10323# Shape Technical Center, The Hague (Netherlands).
THE PERFORMANCE OF METEOR-BURST COMMUNICATIONS AT DIFFERENT FREQUENCIES
D. W. Brown and H. P. Williams *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 26 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

The phenomenon of propagation via meteor trails is reviewed, and the STC meteor burst communication system, COMET, which used ARQ and diversity reception to provide several telegraph channels on a 1000 km path is described. Results of extensive testing of COMET at frequencies near 40 and 100 MHz are presented. Signal level statistics, as well as burst length and interval statistics, are included for both frequencies. The traffic capacity of the COMET system at the two frequencies was compared, based on extensive trials, using simple yagi antennas and transmitter powers of 200 W and 2000 W at 40 and 100 MHz, respectively. Reasons for the observed dependance were developed, and it was due primarily to the physics of meteor propagation, rather than to inefficiencies in the COMET system. Two possible applications of a COMET system, a low capacity jamming resistant circuit and a reliable orderwire for an HF system, are briefly discussed and suggested circuit parameters set out. J.A.M.

N79-10324# California Microwave, Inc., Fullerton.
COMMUNICATIONS VIA METEOR TRAILS
Frank J. Sites *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 21 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

The state-of-the-art of meteoric communications, basic meteoric conditions, system engineering implications, and why these developments constitute a departure from, or provide unique applications of, current technology were addressed. A brief historical development was provided and followed by an explanation of the nature, availability, and radio characteristics of meteor trails. Such material included justified propagation-availability models, availability improvement techniques, optimization of radio system provisions, and other new information. It was shown that a departure from conventional bistatic paths, point-to-point practices, and brute force techniques promoted a host of unique and intriguing system possibilities. J.A.M.

N79-10325# Shape Technical Center, The Hague (Netherlands).
PROPAGATION MEASUREMENTS ON THE ACE-HIGH TROPOSCATTER SYSTEM
A. N. Ince and I. M. Vogt *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 22 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

To predict the propagational reliability of the ACE High troposcatter system, extensive measurements were carried out over a period of two years (1963-1965) on several links which were selected to typify geographical and meteorological conditions in the system. The measurement program consisted of: (1) long term measurements of the transmission loss on seven links, one in Norway, two in Germany, and four in the Mediterranean and (2) measurement of the multipath intermodulation noise on five links. J.A.M.

N79-10326# CNR, Inc., Needham, Mass.
A REVIEW OF SIGNAL PROCESSING FOR SCATTER COMMUNICATIONS
Phillip A. Bello *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 23 p refs (For primary document see N79-10299 01-32)
Avail: NTIS HC A23/MF A01

The state-of-the-art in effective communications techniques was reviewed for fading multipath distorted radio links. The system function parameters of important radio links were defined, and the relationship between the values of these parameters and the selection of appropriate modulation and demodulation techniques is discussed. Reliable communication over fading dispersive channels required the utilization of diversity communications. In addition to the conventional forms of diversity, such as space, frequency, angle, and polarization, advanced communication techniques make use of signal diversity which existed in the signal structure of the received digital modulation waveform by virtue of the time and frequency selectivity of the channel. Utilization of modem and coding techniques to exploit signal diversity is discussed and error rate curves presented. J.A.M.

N79-10327# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).

MAXIMUM USABLE BANDWIDTH AND FREQUENCY DIVERSITY IN TROPOSCATTER COMMUNICATION

R. Valentin *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 10 p refs (For primary document see N79-10299 01-32)

Avail: NTIS HC A23/MF A01

Measurements concerning the maximum usable bandwidth, as well as the frequency distance necessary for frequency diversity, were performed on a 420 km tropospheric scatter path. A carrier frequency of 1.89 GHz and two side bands with variable frequency spacing up to 4 MHz were transmitted. The received scatter-mode signals referring to the three different frequencies were correlated by means of an electronic correlator. It was possible to obtain the frequency correlation function, which determined the maximum usable bandwidth and the frequency diversity spacing. Author

N79-10328# GEC-Marconi Electronics Ltd., Chelmsford (England). Research Labs.

TROPOSCATTER ANGLE DIVERSITY IN THEORY AND PRACTICE

M. W. Gough, G. C. Rider, and R. Larsen *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 14 p refs (For primary document see N79-10299 01-32)

Avail: NTIS HC A23/MF A01

Background work on the behavior of angle diversity in the troposcatter mode is briefly reviewed, together with some important applications. Favorable predictions of angle diversity behavior, based on established theory and limited experimental validation, have encouraged confirmatory trials on an established oversea troposcatter link temporarily adapted for angle diversity working. Trials at the U.K. terminal involved simultaneous comparison between a reference dual (angle/space) diversity system and optimized angle diversity systems, involving horizontally splayed beams and latterly vertically splayed beams. The horizontally offset system yielded channel cross correlations and post-combiner relative efficiencies, well in keeping with theoretical prediction, while the vertically offset system performed significantly better than predicted. J.A.M.

N79-10329# Mitre Corp., Bedford, Mass.

AN EXPERIMENTAL PROGRAM LEADING TO DEVELOPMENT OF A TACTICAL DIGITAL TROPOSCATTER SYSTEM

A. Sherwood, S. Wenglin, and J. Wick *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 16 p refs (For primary document see N79-10299 01-32)

Avail: NTIS HC A23/MF A01

An extensive test program was undertaken to characterize the multipath nature of tactical troposcatter links. The data was used to prepare the design specifications for the AN/TRC-170 troposcatter terminals. A performance prediction technique was derived which considers the variability in path loss and multipath spreading and the effect of this variability on modem performance to predict the usable range of this equipment. J.A.M.

N79-10330# Defense Communications Engineering Center, Reston, Va.

PROPAGATION MEASUREMENTS ON A TRANSALPINE OVER-THE-HORIZON PATH

J. L. Osterholz, P. T. Nielsen, E. Pusone, and I. M. Vogt *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 17 p refs Prepared in cooperation with Shape Tech. Center, The Hague (For primary document see N79-10299 01-32)

Avail: NTIS HC A23/MF A01

Results of propagation measurements on a transhorizon UHF path are presented. The path was a 287 km forward scatter link between southern Germany and northern Italy, traversing the Swiss Alps. Measurements were carried out during the period January to June 1977. The results illustrate the large variation in propagation characteristics, caused by a diurnally fluctuating mixture of troposcatter and diffraction propagation. Received signal level predictions, based on a detailed topographic analysis of the test link, and measured data were shown to be in reasonable agreement. Frequent periods of rapid fading attributed to aircraft passage through the scatter volume were noted, and data were presented which characterizes aircraft passage events, according to their signal level and differential delay profiles. J.A.M.

N79-10331# Laboratoire d'Etude des Transmissions Ionospheriques, Cachan (France).

USE OF PSEUDO-ORTHOGONAL CODES IN RANDOM MULTIPATH CHANNELS

F. Chavand, M. Gindre, and C. Goutelard *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 23 p refs In FRENCH; ENGLISH summary (For primary document see N79-10299 01-32)

Avail: NTIS HC A23/MF A01

Use of pseudo-orthogonal codes allowed an increase in bit rate while a very low error ratio was guaranteed. Pseudo-orthogonal codes classification and codes construction algorithms were considered. These codes were used in multipath ionospheric channel transmissions. Errors in a particular path, caused by interference of the other propagation modes, were corrected by the redundancy introduced by pseudo-orthogonal codes. J.A.M.

N79-10332# CNR, Inc., Needham, Mass.

MLT-1: AN EXPERIMENTAL MODEM FOR TROPOSCATTER COMMUNICATIONS USING MAXIMUM LIKELIHOOD SEQUENCE ESTIMATION AND ERROR-CORRECTION CODING

David Chase and Phillip A. Bello *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 14 p refs (For primary document see N79-10299 01-32) (Contract F30602-74-C-0133)

Avail: NTIS HC A23/MF A01

A new high speed troposcatter, digital modem, designated MLT-1, is discussed. This modem combined coding and modulation and achieved unprecedented reliability by exploiting the scatter properties of this channel to achieve in-band time and frequency diversity. Experimental results for a tactical single diversity troposcatter modem operating at uncoded data rates of 4.6 Mb/s and a coded data rate of 2.3 Mb/s are presented. Author

N79-10333# Shape Technical Center, The Hague (Netherlands).

AN EXPERIMENTAL MODEM FOR HF CHANNELS USING SPREAD-SPECTRUM AND BLOCK ENCODING

R. E. Schemel and A. N. Ince *In* AGARD Aspects of Electromagnetic Wave Scattering in Radio Commun. Sep. 1978 5 p refs (For primary document see N79-10299 01-32)

Avail: NTIS HC A23/MF A01

An experimental program was developed to investigate the performance of a spread spectrum HF modem, designed to combat multipath and interference effects. The design of a prototype system is outlined, and performance results are discussed. The features of the modem included automatic synchronization, diversity operation, provision for an ARQ mode, and more elaborate coding methods. J.A.M.

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N79-10334 California Inst. of Tech., Pasadena.
PHASE AND AMPLITUDE STABILIZATION OF SUPERCONDUCTING RESONATORS Ph.D. Thesis
Jean Roger Delayen 1978 148 p
Avail: Univ. Microfilms Order No. 7815210

The solution suggested involves operating the resonators in self-excited loops, and electronically modifying the loop parameters in order to lock the loop oscillations to an external phase and amplitude reference without attempt to modify the instantaneous resonator eigenfrequency. It is found that this method of phase stabilization is well suited to resonators with small energy contents and small eigenfrequency deviations since the power required is equal to their product; this occurs when the loaded bandwidth of the resonator is twice the maximum eigenfrequency deviation to be compensated for. A microprocessor-controlled feedback system based on this analysis is then described and results of experiments performed in conjunction with a 150 MHz lead (Pb) plated superconducting split-ring resonator are presented. The experiments show excellent agreement with the analysis. Dissert. Abstr.

N79-10335 California Univ., Davis.
MAGNETIC RESONANCE IN AMORPHOUS BUBBLE FILMS Ph.D. Thesis
Li-Yu Chen 1978 78 p
Avail: Univ. Microfilms Order No. 7815497

Ferromagnetic and spin wave resonance experiments were performed on sputtered amorphous Gd-Co and Gd-Co-Mo thin magnetic bubble films. Film parameters such as the effective spectroscopic splitting factor, linewidth, uniaxial anisotropy field, saturation magnetization, and exchange constant were directly measured. In turn, the bubble quality factor, characteristic length, and critical velocity were deduced. The measured line broadening was used to determine the percentage variation of the lattice constant about the crystalline value via a simple model of exchange constant dependence on lattice constant. Experiments were performed at low temperature to study the temperature dependence of sample properties. In some films, one or two high field peaks, in addition to the main resonance and associated spin wave peaks were observed. These observations are explained in terms of film surface layers and uniaxial anisotrophy and magnetization variation across the film thickness. Dissert. Abstr.

N79-10336 West Virginia Univ., Morgantown.
THE CONCEPT AND FEASIBILITY STUDIES OF SIX-PHASE (MULTI-PHASE) ELECTRICAL TRANSMISSION SYSTEMS Ph.D. Thesis
Navinchandra B. Bhatt 1978 193 p
Avail: Univ. Microfilms Order No. 7816999

The technical and economic feasibility of multiphase transmission lines was studied in terms of increasing the transmission capacity of any bulk power transmission system. The economic analysis of the six-phase lines was performed using the rate of return method. Results indicate that the economical performance of the existing 138 kV double circuit lines could be improved by converting them to six-phase lines. Technical feasibility studies conducted include reliability, electrical performance, three-phase/six-phase transformation, and combined three-phase/six-phase load-flow. Results include: (1) steady-state performance of the six-phase lines in case of no contingency or single and multiple contingency is better than that of three-phase double circuit lines; (2) conversion to six-phase lines would lead to increased transmission capability in terms of surge impedance and thermal loadings; (3) a transformation can be accomplished using the conventional transformers; and (4) conversion of 29 lines in a 122 line system would lead to better steady-state performance of the entire system. Dissert. Abstr.

N79-10337* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LIGHTNING CURRENT WAVEFORM MEASURING SYSTEM Patent
Ronald J. Wojtasinski, Jerry C. Fuchs (Federal Electric Corp., Paramus, N.J.), and Charles H. Grove, inventors (to NASA) (Federal Electric Corp., Paramus, N.J.) Issued 11 Jul. 1978 6 p Filed 30 Mar. 1977 Supersedes N77-21220 (15 - 12, p 1577)
(NASA-Case-KSC-11018-1; US-Patent-4,100,487; US-Patent-Appl-SN-782693; US-Patent-Class-324-96; US-Patent-Class-324-72; US-Patent-Class-324-133) Avail: US Patent Office CSCL 09A

An apparatus is described for monitoring current waveforms produced by lightning strikes which generate currents in an elongated cable. These currents are converted to voltages and to light waves for being transmitted over an optical cable to a remote location. At the remote location, the waves are reconstructed back into electrical waves for being stored into a memory. The information is stored within the memory with a timing signal so that only different signals need be stored in order to reconstruct the wave form.
Official Gazette of the U.S. Patent Office

N79-10338* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIME DOMAIN PHASE MEASURING APPARATUS Patent
Victor S. Reinhardt, inventor (to NASA) Issued 3 Oct. 1978 6 p Filed 8 Dec. 1977 Supersedes N78-15401 (16 - 06, p 0752)
(NASA-Case-GSC-12228-1; US-Patent-4,118,665; US-Patent-Appl-SN-858764; US-Patent-Class-324-57R; US-Patent-Class-324-83D; US-Patent-Class-324-85; US-Patent-Class-328-163) Avail: US Patent Office CSCL 09A

The phase and/or period stability of a device is determined by connecting the device in one orthogonal arm of a phase detector having a mixer. In the other arm is an adjustable, variable phase shift device. The output of the mixer is fed through an active low pass filter to derive a DC voltage indicative of the phase shift. The variable phase device is adjusted so that the DC voltage will nullify the phase shift of the tested device under normal conditions. The DC voltage level is converted into a time interval indicative of the phase change of the tested device by determining when the level equals the amplitude of a low frequency ramp voltage. The interval between adjacent equality points can be measured or the period between a reference point on the ramp voltage and the quality be measured.
Official Gazette of the U.S. Patent Office

N79-10339* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRAVELING WAVE TUBE CIRCUIT Patent
Denis J. Connolly, inventor (to NASA) Issued 3 Oct. 1978 4 p Filed 15 Feb. 1977 Supersedes N77-17360 (15 - 08, p 1025)
(NASA-Case-LEW-12013-1; US-Patent-4,118,671; US-Patent-Appl-SN-768795; US-Patent-Class-330-43; US-Patent-Class-315-3.5; US-Patent-Class-315-3.6; US-Patent-Class-301-82) Avail: US Patent Office CSCL 09A

A traveling wave tube (TWT) has a slow wave structure (SWS) which is severed into two or more sections. A signal path, connects the end of an SWS section to the beginning of the following SWS section. The signal path comprises an impedance matching coupler (IMC), followed by an isolator, a variable phase shifter, and a second IMC. The aggregate band pass characteristic of the components in the signal path is chosen to reject, or strongly attenuate, all frequencies outside the desired operating frequency range of the TWT and yet pass, with minimal attenuation in the forward direction, all frequencies within the desired operating frequency range. The isolator is chosen to reject, or strongly attenuate, waves, of all frequencies, which propagate in the backward direction. The aggregate phase shift characteristic of the components in the signal path is chosen to apply signal power to the beginning of the following SWS section with the phase angle yielding maximum efficiency.
Official Gazette of the U.S. Patent Office

N79-10340 George Washington Univ., Washington, D. C.
A CLASS OF MULTIBEAM LENS ANTENNAS UTILIZING ORTHOGONAL POLARIZATIONS FOR SATELLITE COMMUNICATIONS APPLICATIONS Ph.D. Thesis
Randall William Kreutel, Jr. 1978 236 p
Avail: Univ. Microfilms Order No. 7816552

The characteristics of the hyperboloid lens with a short dipole feed element are described. Radiation patterns of the lens are computed, using vector diffraction theory. Characteristics of the lens material are examined, including refractive index, loss, thickness, volume, and weight. A review of the effects of lens surface reflections is presented and a surface matching technique is described. The mutual coupling effects of a crossed dipole array are examined. A simple synthesis procedure is developed to give the parameters of a polarizing network which will provide, in the presence of mutual coupling, any specified polarization state. The limitations associated with beam coupling in multiple beam antennas are reviewed, the general procedures for synthesizing shaped beams are discussed, and some of the possible networks used for forming beams are presented. Two design examples are also presented. Dissert. Abstr.

N79-10341*# Hughes Aircraft Co., Newport Beach, Calif. Microelectronics Products Div.
DESIGN, PROCESSING AND TESTING OF LSI ARRAYS HYBRID MICROELECTRONICS TASK Final Report, 3 Aug. 1977 - 2 Aug. 1978
R. P. Himmel, S. M. Stuhlbarg, and S. Salmassy 15 Sep. 1978 91 p
(Contract NAS8-32607)
(NASA-CR-150832; P78-549) Avail: NTIS HC A05/MF A01 CSCL 09C

Those factors affecting the cost of electronic subsystems utilizing LSI microcircuits were determined and the most efficient methods for low cost packaging of LSI devices as a function of density and reliability were developed. B.B.

N79-10342# Army Mobility Equipment Command, Fort Belvoir, Va.
BASELINE TESTS OF THE EVA METRO ELECTRIC PASSENGER VEHICLE Final Report
Edward J. Dowgiallo, Jr., Cornelius E. Bailey, Jr., Ivan R. Snelling, William H. Blake, and Donald Sherwood May 1978 132 p
(Contract EC-77-A-31-1042)
(AD-A056927; MERADCOM-2244; DOE/CONS-0421-1) Avail: NTIS HC A07/MF A01 CSCL 13/6

The EVA Metro is a four-passenger Renault 12 Sedan that has been converted to an electric vehicle. It was tested as part of a Department of Energy (DOE) project to characterize the state-of-the-art of electric vehicles. The EVA Metro Sedan vehicle performance test results are presented in this report. The EVA Metro is powered by sixteen, 6 volt traction batteries through a silicon-controlled rectifier (SCR) controller actuated by a foot throttle to change the voltage applied to a 10 kW motor. The braking system is a power-assist, hydraulic braking system with front-wheel disk and rear drum. Regenerative braking is not provided. GRA

N79-10343# Pennsylvania Univ., Philadelphia. Dept. of Computer and Information Sciences.
AUTOMATED TEST DESIGN Final Report, 30 Jun. 1975 - 31 Aug. 1977
Cihan Tinaztepe Jun. 1978 303 p refs
(Contract DAAA25-75-C-0650; DA Proj. 1G6-63622-AJ-29)
(AD-A056660; Rept-77-0315; ECOM-75-0650-F-2) Avail: NTIS HC A14/MF A01 CSCL 09/3

A methodology for designing tests to diagnose and isolate failures in analog circuits has been developed and implemented as a computer program. The input to the program consists of a circuit description and a list of possible failures as changes to the nominal unit under test. The output of the program consists of a report showing how well the failures can be isolated, the tests to be performed, and the diagnosis selection logic which combines these tests to isolate the faulty components. The final output is produced in the NOPAL (nonprocedural OPAL) test specification language. Author (GRA)

N79-10344# Rome Air Development Center, Griffiss AFB, N.Y.
PERIODIC MAGNETOSTATIC SURFACE WAVE TRANSDUCERS
J. C. Sethares, T. Tsai, and I. Koltunov Apr. 1978 32 p refs
(AD-A057214; RADC-TR-78-78) Avail: NTIS HC A03/MF A01 CSCL 09/1

A theoretical basis for the generation/detection and processing of microwave magnetostatic surface wave signals using periodic structures is developed. Included in the analysis are: infinite and finite length periodic and nonperiodic structures, and radiation resistance for independent as well as interacting transducer electrodes. Finite length meander and grating line transducers and nonuniform current distributions are discussed. The technology has application in microwave signal processing systems. Author (GRA)

N79-10345# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
SEMI-INSULATING GALLIUM ARSENIDE FOR MICROWAVE AND MILLIMETER-WAVE DEVICE APPLICATIONS
Thomas R. Aucoin, Raymond L. Ross, Melvin J. Wade, and Robert O. Savage Jun. 1978 14 p refs
(AD-A056403) Avail: NTIS HC A02/MF A01 CSCL 09/1

A wide variety of semiconductor devices utilizing gallium arsenide (GaAs) are currently under development by the Army for use in secure communication and improved surveillance systems. GaAs is a semiconductor material characterized by a very high electron mobility, a direct band gap of 1.43 eV, and a high intrinsic resistivity (approximately equal to ten to the 8th power ohm/cm). The low field mobility of electrons in GaAs is one of its greatest attributes and offers high frequency operation in devices such as the field effect transistor (FET). The GaAs FET, a critical component in emerging military systems, is experiencing a rapidly expanding use in oscillator, mixer, logic element, power amplification, and low noise/high gain applications. This device threatens to replace virtually all low noise traveling wave tubes at frequencies from 4 to 30 GHz; is an attractive substitute for difficult to manufacture devices such as Gunn diodes for 4 to 8 GHz operation; and, monolithically fabricated as logic gates, can function at speeds to 10 GHz. In general then, GaAs FET's will eventually replace device configurations of more complex circuitry. However, its full potential has not been realized, largely due to the chronic material problems experienced by device manufacturers. GRA

N79-10346# Harry Diamond Labs., Adelphi, Md.
APPLICATION OF PRONY'S METHOD TO TIME-DOMAIN REFLECTOMETER DATA AND EQUIVALENT CIRCUIT SYNTHESIS
Daniel H. Schaubert Jun. 1978 36 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A056735; HDL-TR-1857) Avail: NTIS HC A03/MF A01 CSCL 09/5

The singularity expansion of time-domain reflectometer data has been computed and used to calculate lumped-element equivalent circuits for the impedance of some typical antennas. Prony's algorithm was used to obtain the poles of the antennas: terminal voltage waveform due to a step-like excitation. The residues, however, were calculated subject to the uniform error norm instead of the least squared error norm. Although it requires much longer to calculate, the uniform error norm approximation is often orders of magnitude better than the least squared error approximation. The physical realizability of impedance functions obtained from experimental data has been investigated. Also, the procedures necessary to synthesize the lumped-element network have been evaluated. A simple partial fraction expansion of a realizable impedance function representing an antenna was found to yield nonrealizable element values. A general network synthesis procedure, such as Brune's method, is required. Author (GRA)

N79-10347# Sandia Labs., Albuquerque, N. Mex.
EXPLOSIVELY ACTUATED FAST-OPENING SWITCHES FOR VERY LARGE CURRENTS Final Report
Robert I. Butler and Billy W. Duggin Feb. 1978 31 p
(Contract AT(29-1)-789)
(AD-A056578; SAND-77-1438; AFWL-TR-78-501) Avail:

NTIS HC A03/MF A01 CSCL 09/5
In a series of eight experiments the use of high explosives to interrupt electric current by fast-opening switch mechanisms was investigated. The conducting link in seven of the experiments was a glass-lined plasma-filled cavity that was closed explosively. In the eighth experiment a foam-metal link was driven into the liquid-vapor phase and expanded into a ceramic cavity. Resistance increases and resultant voltage spikes that corresponded in time with the particle velocities of the collapsing walls were obtained. However, unknown high-resistance paths prevented voltage gradients greater than 100,000 to 10 to the 6th power V/m.
Author (GRA)

N79-10348# RCA Government and Commercial Systems, Burlington, Mass. Automated Systems Div.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM. AUTOMATIC IN-PROCESS MICROCIRCUIT EVALUATION (AIME) Quarterly Progress Report, 1 Jan. - 31 Mar. 1978
R. J. Wildenberger and L. Arlan May 1978 63 p refs
(Contract DAAB07-77-C-0585)
(AD-A056589; QPR-2) Avail: NTIS HC A04/MF A01 CSCL 14/2
This report covers the work performed on the AIME equipment task during the period 1 January to 31 March 1978. It presents a technical and physical description of the Development Model equipment design and configuration. The work accomplished during the quarter and the task schedule are also presented. Plans for the next quarter have been developed and are outlined herein.
Author (GRA)

N79-10349# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
HIGH-SPEED ELECTRON-BEAM LITHOGRAPHIC RESISTS FOR MICRON AND SUBMICRON INTEGRATED CIRCUITS
John N. Helbert, Charles C. Cook, Jr., and Edward H. Poindexter Jun. 1978 11 p refs
(AD-A056446) Avail: NTIS HC A02/MF A01 CSCL 13/8
Next-generation RADAR and ELINT systems are planned to provide the field commander with comprehensive intelligence on the disposition of enemy weapons and electronics equipment. Ultra-compact signal processors with unprecedented capabilities are the heart of these systems. Fabrication of the required high-density integrated circuits (IC's), with elements in the micron to submicron range, is beyond the resolution limit of state-of-the-art optical photolithography. Electrons with 10-20 keV energies can be accurately focused to beam diameters much less than a micron. Electron-beam lithography (EBL) meets the projected resolution requirements, and is expected to be a key technology for the production of sophisticated new digital communications systems for the Army.
GRA

N79-10350# Army Engineer Topographic Labs., Fort Belvoir, Va.
DIRECT ELECTRONIC FOURIER TRANSFORMS (DEFT) FOR CAMOUFLAGE SIGNATURE MEASUREMENT (CSM)
Joseph F. Hannigan Jun. 1978 15 p refs
(AD-A056442) Avail: NTIS HC A02/MF A01 CSCL 17/5
The concept and technique is based on the Fourier transform of an image, and the method uses one of the most recent advances in surface acoustic wave (SAW) technology together with modern communications technology to obtain the camouflage signature measurement (CSM) of military objects. This SAW device produces an analog (RF) electrical signal containing the Fourier transform (including amplitude, frequency, and phase) of the spatial frequencies contained in a conventional image.
GRA

N79-10351# Naval Avionics Facility, Indianapolis, Ind.
EVALUATION OF CERAMIC DIP CARRIER
William J. Musgrave 30 Jun. 1978 88 p
(AD-A056653; NAC-TR-2231) Avail: NTIS HC A05/MF A01 CSCL 09/5
A system of mounting dual in-line packages on ceramic substrates without the use of conventional through-holes is found to be feasible. Thermal information relating to substrate performance is developed. A protective coating for copper is discovered.
Author (GRA)

N79-10352# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.
DESIGN OF DIGITAL SYSTEMS USING SELF-CHECKING ALTERNATING LOGIC Ph.D. Thesis
Scott Eugene Woodard Oct. 1977 126 p refs
(Contract DAAB07-72-C-0259)
(AD-A056534; R-788; UILU-ENG-77-2235) Avail: NTIS HC A07/MF A01 CSCL 09/5
This thesis presents analysis of the application of alternating logic to the design of self-checking systems. In particular, results are presented in the areas of combinational logic, sequential logic, self-checking alternating logic modules, self-checking alternating logic checker design, and self-checking alternating logic system design. The necessary and sufficient conditions for a self-dual combinational network to be self-checking are developed. An analytic technique for evaluating if any self-dual network is self-checking is given. A memory efficient approach for the design of self-checking alternating logic sequential machines is presented. Various techniques of checker design for self-checking alternating logic are discussed. The requirements of the hardcore portion of general self-checking systems is given. Minority modules are shown to be sufficient to convert any NAND or NOR network to a self-checking alternating logic network.
GRA

N79-10353# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.
TIME DOMAIN ANALYSIS OF SAW FILTERS
Carl Michael Panasik May 1977 56 p refs
(Contracts DAAB07-72-C-0259; F33615-75-C-1291)
(AD-A056890; R-781; UILU-ENG-77-2228) Avail: NTIS HC A04/MF A01 CSCL 09/5
A Surface Acoustic Wave (SAW) device consists of two transducers with interleaved aluminum fingers on a piezoelectric substrate. The input transducer is implemented with fingers of equal length, while the output transducer has fingers with varied overlap. The filter operates by electrically exciting the input transducer which through the piezoelectric effect causes a surface wave along with other modes to propagate toward the output transducer. There the wave is transformed back into an electrical signal. The output transducer works in a manner similar to a digital filter and can be modeled as a tapped delay line of N fingers where (1) each finger is a delta function generator-detector of surface waves, (2) the constant propagation time between fingers is the unit delay time t, (3) the variable finger overlap (apodization) is proportional to an attenuator weight Wk and (4) the relative direction of overlap with respect to the direction of propagation determines the relative sign of that tap.
Author (GRA)

N79-10354# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MODAL ANALYSIS OF SAW CONVERTER
Carl L. Wang 13 Jan. 1978 40 p refs
(Contract F19628-78-C-0002; ARPA Order 2929)
(AD-A056809; ESD-78-3; TR-526) Avail: NTIS HC A03/MF A01 CSCL 09/5
The gap-coupled acoustoelectric convolver developed at Lincoln Laboratory is a surface-acoustic-wave (SAW) device consisting of a LiNbO3 delay line and a silicon strip supported on a series of spacer rails (or posts) which have been ion-beam etched into the LiNbO3 surface. The silicon/air-gap/LiNbO3 structure forms an over-moded acoustic waveguide. A theoretical model has been developed which analyzes the perturbing effect of rails and predicts the mode structure and beating phenomena between modes. The scattering by support posts is also analyzed.
Author (GRA)

N79-10355# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.
COMPUTER AIDED DESIGN, DESIGN AUTOMATION AND LSI KEYS TO HIGH-PERFORMANCE MILITARY ELECTRONICS
Randolph A. Reitmeyer, Jr. Jun. 1978 11 p
(AD-A056479) Avail: NTIS HC A02/MF A01 CSCL 09/5
The Army is faced with the task of developing new and vastly improved electronic systems to meet the challenge of sophisticated, high-mobility, future battlefields. In general, this

challenge requires the use of complex, custom, high-speed, low-power, large scale integrated circuits (LSICs) and very large scale integrated circuits (VLSICs). The successful development of such circuitry is dependent on the availability of advanced integrated circuit (IC) fabrication technologies, e.g., complementary metal oxide semiconductor/silicon on sapphire (CMOS/SOS) and gallium arsenide (GaAs) and on the availability of affordable design and design verification capabilities. GRA

N79-10356# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
LINEAR DEVICE APPLICATIONS ANALYSIS: DELTA SIGMA MODULATOR STUDY Final Report, Sep. 1976 - Oct. 1977
Peter A. Welling Sep. 1977 52 p
(Contract F33615-75-C-1149)
(AD-A056379; R-1114; AFAL-TR-77-246) Avail: NTIS HC A04/MF A01 CSCL 09/5

The report describes the operation of the delta sigma modulator A-D converter and addresses the issues of integrating and hardening the circuit. The input/output relationship of the converter is stated for both DC and AC signals. A survey of commercial converters which use delta sigma modulation or related techniques is summarized. Various current switch designs, amplifier technologies, and resistive materials are examined to develop a radiation hard, integrated circuit configuration. A design which automatically nulls offset in the converter is outlined.
Author (GRA)

N79-10357# Harris Corp., Syosset, N. Y. PRD Electronics Div.
MM AND T PROGRAM TO ESTABLISH PRODUCTION TECHNIQUES FOR THE AUTOMATIC DETECTION AND QUALIFICATION OF TRACE ELEMENTS PRESENT IN THE PRODUCTION OF MICROWAVE SEMICONDUCTORS
Roy W. Spacie Feb. 1978 66 p
(Contract DAAB07-77-C-0561)
(AD-A056957; ECOM-77-0561-2-QR-2) Avail: NTIS HC A04/MF A01 CSCL 09/1

A project was undertaken to improve the yield in the manufacture of microwave semiconductor diodes by establishing the correlation of product yields to the incidence of contaminants in the reagents and solvents used in the manufacturing process and using these data to model the process for optimization of the yield. Author (GRA)

N79-10358# Oak Ridge National Lab., Tenn.
INVESTIGATION OF CURRENT TRANSFER IN BUILT-UP SUPERCONDUCTORS
J. R. Miller, L. Dresner, and J. W. Lue 1977 21 p Presented at 7th Symp. on Fusion Research Project, Knoxville, Tenn., 25 Oct. 1977
(Contract W-7405-eng-26)
(CONF-771029-106) Avail: NTIS HC A02/MF A01

Superconductors carrying 10 kA or more were suggested for use in fusion research and reactor magnets. Built-up or cable conductors were proposed in which a superconductor is concentrated in part of the conductor or part of the strands while the stabilizers occupies the rest. A substantial savings in manufacturing cost and a reduction of ac losses is developed. Two types of conductors were constructed for the experimental test. Triplex conductors consisting of either three superconducting wires or two superconducting plus one copper wire were used to simulate cables. Laminated superconductor and copper strips with different soldering bonds were used for build-ups. Normal zone propagation and recovery experiments were performed and results are compared with the theory. DOE

N79-10359# Westinghouse Electric Corp., Pittsburgh, Pa. Research and Development Center.
LIGHT-FIRED THYRISTOR DEVELOPMENT Interim Report
D. J. Page, Lewis L. Lowry, and Prosenjit Rai-Choudhury Apr. 1978 164 p
(EPRI Proj. 567-1)
(EPRI-EL-776) Avail: NTIS HC A08/MF A01

A high power light-triggered thyristor was developed and demonstrated. A series-connected string of eight such thyristors was tested to show feasibility for commercial utility applications in VAR generator applications. The chief benefit derived from light-triggered thyristors is that a high voltage stack of such thyristors can be switched directly by a light signal transmitted through electrically insulating fiber optics cables. Design considerations applicable to light-triggered thyristors are described and means of optimizing the light source-fiber optic cable system are discussed. A hermetically sealed package for light-triggered thyristors is described. Test results on individual light-triggered thyristors are presented, and the operation of a module consisting of light source, fiber optics cables, and a series string of eight light-triggered thyristors is described. DOE

N79-10360# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
EXPERIMENTAL DETERMINATION OF THE ORDER PARAMETER: RESPONSE FUNCTION OF A SUPERCONDUCTOR
A. M. Goldman 1977 13 p Presented at NATO Advanced Study Inst. on Correlation Functions and Quasiparticle Interactions, WYZATA, Minnesota, 22 Aug. 1977
(Contract EY-76-S-02-1569)
(COO-1569-145; Conf-770872-1) Avail: NTIS HC A02/MF A01

Studies of the dynamics of the superconducting order parameter were undertaken above and below T/sub c/. Above T/sub c/ the time dependent Ginzburg-Landau equation accurately describes the dynamics. Below T/sub c/ a propagating mode is found which can be associated with fluctuations in the phase of the order parameter. Measurements of the magnetic impurity dependence of the response function have been used to study the anomalous term in the Gor'kov-Eliashberg theory which gives the coupling between order parameter fluctuations and fluctuations in the quasiparticle distribution function. Below T/sub c/ and in a current-carrying state, amplitude and phase fluctuations are coupled and the modes soften at the critical current. DOE

N79-10361# United Technologies Research Center, East Hartford, Conn.
FAR-INFRARED INSPECTION OF CABLE INSULATION Interim Report
P. K. Cheo Apr. 1978 91 p refs
(ERPI-EL-738) Avail: NTIS HC A05/MF A01

The results of an effort to study the feasibility of real-time, in-process detection of voids and contaminants in polyethylene insulation of power cables are delineated. The detection technique involves the application of far-infrared laser scattering from defects imbedded in the insulation. The effort included the demonstration of noncontacting, nondestructive, real-time detection of voids, and contaminants in: (1) thin slabs of polyethylene and cross-linked polyethylene materials, (2) a stationary 25 kV power cable, and (3) the same cable in motion. A far-infrared laser transceiver system was constructed and used for these demonstrations. A numerical procedure was developed to compute the Mie-scattering radiation patterns from spherical voids in polyethylene, and to trace the rays through power cable insulation. An index-matching technique was developed and employed successfully to permit the detection of scattered laser radiation from power cable insulation. DOE

N79-10362# National Technical Information Service, Springfield, Va.
ACOUSTIC SURFACE WAVES, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Apr. 1976 - Jun. 1978
William E. Reed Jul. 1978 107 p Supersedes NTIS/PS-77/0584; NTIS/PS-76/0367; NTIS/PS-75/249
(NTIS/PS-78/0719/1; NTIS/PS-77/0584; NTIS/PS-76/0367; NTIS/PS-75/249) Avail: NTIS HC $28.00/MF $28.00 CSCL 09A

Surface wave devices, techniques, and applications are cited. Topics include signal processing, amplification, propagation, delay lines, transducers, and filters. This updated bibliography contains 101 abstracts, 32 of which are new entries to the previous edition. GRA

N79-10363# National Technical Information Service, Springfield, Va.
ELECTRIC AUTOMOBILES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1978

Audrey S. Hundemann Aug. 1978 220 p Supersedes NTIS/PS-77/0635; NTIS/PS-76/0560; NTIS/PS-75/490 (NTIS/PS-78/0880/1; NTIS/PS-77/0635; NTIS/PS-76/0560; NTIS/PS-75/490) Avail: NTIS HC $28.00/MF $28.00 CSCL 13F

Abstracts of Federally-funded research pertaining to battery systems, costs, and evaluations of electric vehicles are presented. Studies are included on nickel-zinc and lead-acid batteries, various types of lithium cells, and hybrid heat engine/electric systems. This updated bibliography contains 212 abstracts, 60 of which are new entries to the previous edition. GRA

N79-10364# National Technical Information Service, Springfield, Va.

ELECTRIC AUTOMOBILES, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Jul. 1978

Audrey S. Hundemann Aug. 1978 210 p Supersedes NTIS/PS-77/0637; NTIS/PS-76/0561 (NTIS/PS-78/0881/9; NTIS/PS-77/0637; NTIS/PS-76/0561) Avail: NTIS HC $28.00/MF $28.00 CSCL 13F

Citations from worldwide research cover the design of electric automobiles, vans, buses, and hybrid vehicles. Studies are included on lead acid, zinc air, lithium sulfur, and nickel cadmium batteries; fuel cells; drive trains; and chassis construction. This updated bibliography contains 204 abstracts, 41 of which are new entries to the previous edition. GRA

N79-10365# National Bureau of Standards, Boulder, Colo. Electromagnetic Technology Div.

UHF IMPULSE GENERATOR

James R. Andrews and Eugene E. Baldwin Apr. 1978 30 p refs (PB-282887/9; NBSIR-78-880) Avail: NTIS HC A03/MF A01 CSCL 09E

The UHF Impulse Generator is described in detail. A complete parts list and printed circuit artwork are included. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N79-10366 Polytechnic Inst. of New York.

ANALYSIS OF COMPRESSION OF A SMALL SPHERE OF MATTER BY MEANS OF n SUCCESSIVE STRONG IMPLODING SHOCKS Ph.D. Thesis

Yasuichi Fujimoto 1978 102 p

Avail: Univ. Microfilms Order No. 7816749

The imploding shock is induced by the process of ablation, i.e., an energy pulse is delivered at the rim of the sphere, it ionizes and causes a rapidly outwardly expanding plasma. The domain of interaction between matter and energy pulse is idealized by means of the spherical deflagration front which acts thereby as a spherical piston. The fluid between the deflagration front and the shock front follows a self-similar solution of the conservation equations. Expressions for the pressure, density, gas velocity, and temperature are derived. It is shown that the density saturates at about seven times the initial density. A succession of n strong imploding shocks is considered and the state of the sphere is derived. Analysis shows that the small amount of matter is able to be compressed to the superhigh density, 10 to the 26 power particles/cu cm, and heated to the high temperature 5 KeV. Dissert. Abstr.

N79-10367 Auburn Univ., Ala.

A NUMERICAL SCHEME FOR PREDICTING TRANSIENT SHOCK, BOUNDARY LAYER AND MAGNETOHYDRODYNAMIC PHENOMENA Ph.D. Thesis

Laurence Alan Feldman 1978 203 p

Avail: Univ. Microfilms Order No. 7815856

A stable procedure of first order accuracy for solving the coupled axisymmetric transient gasdynamic and electromagnetic equations is presented. A numerical integration technique for inviscid flow was extended to include viscous and electromagnetic terms with stability, convergence and computational speed comparing favorably with other existing hydrocodes. The method was applied to a number of transient hydrodynamic and magnetohydrodynamic applications characterized by the interaction of gasdynamic, electromagnetic and viscous flow phenomena. The external flow field around an M-117 warhead, an ablating re-entry vehicle and a semi-infinite circular cylinder, and the internal flow of a nozzle, shock tube and MHD channel is examined under viscous and inviscid conditions. Attention focused on the behavior of a conducting fluid in the presence of shocks, boundary layers, heat transfer and electromagnetic fields. Dissert. Abstr.

N79-10368 Louisiana State Univ. and A&M Coll., Baton Rouge.

THE EFFECT OF A HORIZONTAL PLANE BOUNDARY ON A FALLING HORIZONTAL CYLINDER AT LOW REYNOLDS NUMBER Ph.D. Thesis

Yang-Jen Chen 1977 79 p

Avail: Univ. Microfilms Order No. 7815616

Experimental results are presented for the change in velocity of a slender cylinder with its axis horizontal as it falls through a viscous fluid toward a horizontal plane boundary. The Reynolds number based on the diameter of the cylinder ranged from 0.015 to 2.9. When the relative change in velocity is small (less than 15%), it is observed to depend inversely on the square of the distance from the boundary. When the boundary influence is large, the deceleration of the cylinder is observed to be constant, and the velocity extrapolates to zero at the boundary. Calculations based on the theory of de Mestre and Russel do not agree well with the experimental results. Inertia is found to be important, and an attempt is made to calculate the added mass of the decelerating cylinder. Dissert. Abstr.

N79-10369 Wisconsin Univ. - Madison.

VELOCITY PROFILES OF EMERGING VISCOELASTIC LIQUID JETS IN THE EXIT REGION Ph.D. Thesis

Moshe Gottlieb 1978 330 p

Avail: Univ. Microfilms Order No. 7811724

An extensive experimental investigation was carried out on the flow of polymeric materials in the exit region of a circular tube prior to their emergence as a horizontal free jet. Complete axial velocity profiles were measured by laser anemometry technique providing information on changes occurring in the velocity profiles as the liquids approach the tube exit. Using macroscopic balances, it is shown that for Newtonian liquids, analyses of extrudate swell that assume fully developed flow up to tube exit yield results which are not in agreement with experimental evidence regarding the dependence of the amount of swell on the jet on the Reynolds number of the flow. It is also shown that for a second order fluid two dimensionless groups are expected to play a role in determining the fluid behavior: the Reynolds number and an elasticity number. Dissert. Abstr.

N79-10370 Polytechnic Inst. of New York.

GAS DYNAMICS ON SINGULAR MANIFOLDS Ph.D. Thesis

Paul D. Smith 1978 97 p

Avail: Univ. Microfilms Order No. 7816643

A non-linear singular Hodge theorem is proved for gas flows on Riemannian manifolds with metric polar singularities. This also extends the result of Bers and Shiffman to gas flows in RN with an embedded obstacle. Because the standard energy functional is infinite over the admissible class of forms, a new functional is constructed. A singular De-Rham theorem is proved. Smoothness of the solutions follows from a theorem of Morrey. A continuous dependence of the solutions on the limiting speeds at the punctures is shown. Dissert. Abstr.

N79-10371 Houston Univ., Tex.

A STUDY OF THE FLOW OF PARTICULATE SUSPENSIONS USING A LASER DOPPLER VELOCIMETER Ph.D. Thesis

John Lee Steimke 1978 350 p

Avail: Univ. Microfilms Order No. 7816215

The motion of droplets and particles suspended in a turbulent air flow was studied. A laser Doppler velocimeter was designed and constructed for use in measuring two components of velocity

for individual droplets or particles. As a check on the accuracy and reliability of the LDV method, LDV measurements were compared with hot wire anemometer measurements for the same flow conditions. In general, the agreement between the two types of measurements was very good. The LDV was also used to measure the velocities of 20 micron dioctylphthalate droplets and 63 micron beads. A variety of statistics were generated. Theoretical predictions were made of the axial mean velocities, the axial root mean square velocities, and the radial root mean square velocities for the entrained particles. Fairly good agreement was observed between theory and data. Dissert. Abstr.

N79-10372 California Inst. of Tech., Pasadena.
STUDIES OF MEAN REYNOLDS STRESS MODELS OF TURBULENT FLOW Ph.D. Thesis
Philip Eric Wood 1978 256 p
Avail: Univ. Microfilms Order No. 7816960

A second order turbulence model is described which calculates the mean Reynolds stresses and dissipation rate for homogeneous and slightly inhomogeneous shear flows. The higher order terms which appear in the exact differential (transport) equations for the Reynolds stresses and dissipation rate are approximated in terms of the mean velocity gradient using some of the principles of invariant modeling. The unknown coefficient appearing in the models for the higher order terms were estimated by a systematic evaluation of the experimental data for homogenous turbulence. The model was used to calculate the Reynolds stresses for homogeneous shear flow, homogeneous strain and the decay of initially anisotropic turbulence. Dissert. Abstr.

N79-10373 New York Univ., N. Y.
A WELL POSED BOUNDARY VALUE PROBLEM IN TRANSONIC GAS DYNAMICS Ph.D. Thesis
Jose M. Sanz 1978 45 p
Avail: Univ. Microfilms Order No. 7818458

A boundary value problem for the Tricomi equation is studied in connection with transonic gas dynamics. The transformed equation in canonical coordinates is considered in the complex domain of two independent complex variables. A boundary value problem is then set by prescribing the real part of the solution on the boundary of the real unit circle. The Dirichlet problem in the upper unit semicircle with vanishing values of the solution is solved explicitly in terms of the hypergeometric function for the more general Euler-Poisson-Darboux equations. An explicit representation of the solution is also given for a mixed Dirichlet and Neumann problem for the same equation and domain.
Dissert. Abstr.

N79-10374 Ohio State Univ., Columbus.
TRANSITION, TURBULENCE, AND OSCILLATING FLOW IN A PIPE: A VISUAL STUDY Ph.D. Thesis
Leslie Stuart Fishler 1978 196 p
Avail: Univ. Microfilms Order No. 7819590

Transitional and turbulent oscillatory flow in a pipe was investigated using a flow visualization technique to establish the existence of coherent flow structures and to describe them. The flow visualization technique involved suspending tracer particles in a fluid to mark the fluid motions and taking high speed motion pictures of the fluid in motion. The geometry used was a rigid, circular, straight pipe of constant cross section with enough entry length on either side to insure fully developed oscillatory flow. There were two major results of these experiments. First, coherent structures for transitional and turbulent oscillatory flow were shown to exist. Secondly, turbulence according to the coherent flow structures depended on the peak Reynolds number and the frequency parameter. Dissert. Abstr.

N79-10375 Rochester Univ., N. Y.
AN EXPERIMENTAL STUDY OF STEADY FLOW IN A PARTIALLY-FILLED ROTATING CYLINDER Ph.D. Thesis
Richard Dulany Whiting 1978 151 p
Avail: Univ. Microfilms Order No. 7818297

The flow in a partially-filled right circular cylinder, with its symmetry axis horizontal, rotating sufficiently rapidly that the air formed a core near the axis of the cylinder, with the liquid held against the wall by centrifugal forces was studied. The motions of the liquid near the interface between the air and liquid were probed using small buoyant particles. The displacement of the air core from a position concentric with the cylinder, and the distortion of the air core from circularity, were also measured. The results were compared with theoretical predictions, with the conclusions that: the motion of the liquid departed from rigid-body rotation in a way that agreed qualitatively with the predictions; there was a motion of the fluid toward the end walls; Stewarston-type bounday layers exist on the air-liquid interface; the air core is depressed from the symmetry axis of the cylinder; and the shape of the air core departs from circularity in a way consistent with theory. Dissert. Abstr.

N79-10376*# National Aeronautics and Space Administration, Washington, D. C.
NONLINEAR AXISYMMETRIC LIQUID CURRENTS IN SPHERICAL ANNULI
N. M. Astafyeva, N. D. Vvedenskaya, and I. M. Yavorskaya Oct. 1978 55 p refs Transl. into ENGLISH of "Nelineynyye Osesimmetrichnyye Techeniya Zhidkosti v Sfericheskikh Sloyak", Rept-385 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-55 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75559; Rept-385) Avail: NTIS HC A04/MF A01 CSCL 20D

A numerical analysis of non-linear axisymmetric viscous flows in spherical annuli of different gap sizes is presented. Only inner sphere was supposed to rotate at a constant angular velocity. The streamlines, lines of constant angular velocity, kinetic energy spectra, and spectra of velocity components are obtained. A total kinetic energy and torque needed to rotate the inner sphere are calculated as functions of Re for different gap sizes. In small-gap annulus nonuniqueness of steady solutions of Navier-Stokes equations is established and regions of different flow regime existances are found. Numerical solutions in a wide-gap annulus and experimental results are used in conclusions about flow stability in the considered range of Re. The comparison of experimental and numerical results shows close qualitative and quantitative agreement. S.B.S.

N79-10377*# Old Dominion Univ., Norfolk, Va. School of Engineering.
DEVELOPMENT OF A THREE-DIMENSIONAL NAVIER-STOKES CODE ON CDC STAR-100 COMPUTER Final Report, 1 Sep. 1977 - 31 Oct. 1978
Veer N. Vatsa and G. L. Goglia Oct. 1978 43 p refs
(Grant NsG-1226)
(NASA-CR-157892) Avail: NTIS HC A03/MF A01 CSCL 20D

A three-dimensional code in body-fitted coordinates was developed using MacCormack's algorithm. The code is structured to be compatible with any general configuration, provided that the metric coefficients for the transformation are available. The governing equations are developed in primitive variables in order to facilitate the incorporation of physical boundary conditions and turbulence-closure models. MacCormack's two-step, unsplit, time-marching algorithm is used to solve the unsteady Navier-Stokes equations until steady-state solution is achieved. Cases discussed include (1) flat plate in supersonic free stream; (2) supersonic flow along an axial corner; (3) subsonic flow in an axial corner at M infinity = 0.95; and (4) supersonic flow in an axial corner at M infinity 1.5. A.R.H.

N79-10378*# Neilsen Engineering and Research, Inc., Mountain View, Calif.
METHODS OF SEPARATION OF VARIABLES IN TURBULENCE THEORY Final Report
Shunichi Tsuge Oct. 1978 66 p refs
(Contract NAS2-9535)
(NASA-CR-3054; NEAR-TR-137) Avail: NTIS HC A04/MF A01 CSCL 20D

Two schemes of closing turbulent moment equations are proposed both of which make double correlation equations separated into single-point equations. The first is based on neglected triple correlation, leading to an equation differing from small perturbed gasdynamic equations where the separation constant appears as the frequency. Grid-produced turbulence is described in this light as time-independent, cylindrically-isotropic turbulence. Application to wall turbulence guided by a new

asymptotic method for the Orr-Sommerfeld equation reveals a neutrally stable mode of essentially three dimensional nature. The second closure scheme is based on an assumption of identity of the separated variables through which triple and quadruple correlations are formed. The resulting equation adds, to its equivalent of the first scheme, an integral of nonlinear convolution in the frequency describing a role due to triple correlation of direct energy-cascading. Author

N79-10379*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A SIPHON METHOD OF DETERMINING RESISTIVITIES OF THIN HEAT-PIPE WICKS
S. Katzoff Oct. 1978 16 p ref
(NASA-TP-1304; L-12266) Avail: NTIS HC A02/MF A01 CSCL 20D

A simple siphon method is described for determining the resistivities of thin heat pipe wicks as a function of the pressure difference between the liquid in the wick and the vapor above it. The method was applied to wicks of one layer and two layers of 100 mesh (40 per centimeter) stainless steel screens diffusion bonded to stainless steel substrates. Some possible improvements in the method are suggested. Author

N79-10380# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.
THEORETICAL PRESSURE CORRELATION FUNCTIONS IN TURBULENT BOUNDARY LAYERS Interim Report
William C. Meecham and Michael T. Tavis 8 Jun. 1978 93 p refs
(Contract F04701-77-C-0078)
(AD-A056434; TR-0078(3606)-2; SAMSO-TR-78-42) Avail: NTIS HC A05/MF A01 CSCL 20/4

A Poisson equation is constructed for the pressure in terms of velocity fluctuations, and solved. The pressure correlation has a second-order velocity fluctuation contribution (usually assumed dominant in past work) and a fourth-order velocity correlation contribution. The velocity correlations are assumed to be those--suitably weighted--found from homogeneous turbulence measurements. Results are computed for two boundary layers: an idealized (canonical) turbulent boundary layer and a deliberately thickened boundary layer. The pressure variances are found to be essentially the same as measured values. The correlations have scales equal to the displacement thickness of the boundary layer. All correlations are positive except the streamwise, x-correlation for the thickened boundary layer. The canonical layer shows a pressure variance that peaks very close to the wall, near the laminar sublayer. The fourth-order velocity fluctuations may be generally neglected for the thickened boundary layer; close to the wall it is an important part of the variance and correlation for the canonical layer. Author (GRA)

N79-10381# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN ANALYTICAL INVESTIGATION OF THE EFFECTS OF FLOW PROPERTY FLUCTUATIONS ON THE FAY-RIDDELL EQUATION M.S. Thesis
William Humphrey Barnett, Jr. Mar. 1978 103 p refs
(AD-A056533; AFIT-GAE/AA/78M-2) Avail: NTIS HC A06/MF A01 CSCL 20/13

The effects of flow property fluctuations on the stagnation point heat transfer rate, as calculated by the Fay-Riddell equation, are investigated. Fluctuations in free stream temperature and density, wall temperature and density, and stagnation pressure are considered. The flow parameter perturbations are included in the Fay-Riddell equation by approximating the heat transfer rate by a Taylor Series truncated to second order and expanded about the mean values of the five independent variables. Taking the time averaged of this expression, the first order terms in the fluctuations drop out, and an expression for the time averaged stagnation point heat transfer rate is obtained. A comparison between the laminar steady flow heat transfer rate and the heat transfer rate with fluctuations shows that neglecting the fluctuations in the five independent variables can lead to errors in the calculated heat transfer rate. Of the five variables considered, the fluctuations of the temperature at the edge of the boundary layer have the greatest effect on the heat transfer rate. GRA

N79-10382# Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.
EXPERIMENTAL EVALUATION OF SAMPLING BIAS IN NATURALLY SEEDED FLOWS Final Report, 1 Apr. 1977 - 31 Jan. 1978
W. G. Tiederman 23 Jun. 1978 34 p refs
(Grant AF-AFOSR-3298-77)
(AD-A056773; EN-78-ME-1; AFOSR-78-1214TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

Individual realization laser velocimeter measurements were made in the viscous sublayer of a turbulent channel flow. The Doppler signals were recorded on magnetic tape and then processed with systematic variations in the triggering levels in the counter processors. Naturally seeded flows were modeled by using 0-10 micrometers test dust for scattering centers while flows seeded with 5-10 micrometers test dust were used as a controlled comparison. Both the number density of the scattering particles and the detection level of the counter processors were independently varied to yield a wide range of particle arrival rates. Also, an attempt was made to prove the existence of sampling bias in naturally seeded flows by comparing the slopes of both the unweighted and the weighted (corrected for sampling bias) velocity profiles with the slope deduced from pressure drop measurements. The results show that sampling bias is not effected by the particle arrival rate. There was, also, no indication that sampling bias is either eliminated for decreased due to differences in the probability for detecting small particles that are moving slowly compared to small particles that are moving fast. The comparisons of velocity gradients with pressure drop measurements were inconclusive. Author (GRA)

N79-10383# Naval Ship Research and Development Center, Bethesda, Md. Computation, Mathematics, and Logistics Dept.
A DISCRETE VORTEX SIMULATION OF A TWO-DIMENSIONAL SHEAR LAYER WITH PREDICTION OF THE HYDRODYNAMIC NOISE
Walter J. Grabowski and John G. Telste Jun. 1978 39 p refs
(ZR0140201)
(AD-A056377; DTNSRDC-78/050) Avail: NTIS HC A03/MF A01 CSCL 20/4

A numerical simulation of the two-dimensional shear layer occurring at the interface of two streams of different velocity is described. The shear layer is represented by a large number of discrete vortices and is allowed to evolve in accordance with the velocity potential of the vortices. It is found that the model effectively simulates the large-scale evolution of the layer. The model, however, is found to be inadequate for predicting the hydrodynamic sound generated in the shear layer because small-scale vortex motion plays a major role in acoustic prediction. Author (GRA)

N79-10384# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
FILM COOLING AND END WALL HEAT TRANSFER IN SMALL TURBINE BLADE PASSAGES Annual Report, Jul. 1976 - Dec. 1977
J. P. Ville, M. Godard, B. E. Richards, and C. Sieverding Feb. 1978 51 p refs
(Grant DA-ERO-75-G-074)
(AD-A057067; VKI-TN-126) Avail: NTIS HC A04/MF A01 CSCL 13/7

Two topics have been studied related to the cooling of the end wall of a turbine passage. The first concerns the development of a method for measuring the adiabatic wall effectiveness and heat transfer coefficient of a film cooling system for protecting a surface from high heating derived from a hot compressible flow. The second concerns the measurement of the heat transfer rate distribution to a turbine cascade end wall in order to choose an appropriate film cooling system. These are related to providing the background to the final phase of the study in which the effectiveness of a film cooling system to cool a turbine end wall will be made combined with the measurement of the aerodynamic losses incurred by such a system. Author (GRA)

N79-10385# Oak Ridge National Lab., Tenn.
MONTE CARLO HEAT CONDUCTION USING THE TRANSPORT EQUATION APPROXIMATION

S. K. Fraley 1977 6 p refs Presented at ANS Winter Meeting, San Francisco, Calif., 27 Nov. 1977
(Contract W-7405-eng-26)
(CONF-771109-54) Avail: NTIS HC A02/MF A01

The use of Monte Carlo radiation transport codes to solve heat conduction problems was shown to be applicable to steady state and time dependent multi-media problems. An improved method for treating problems with given surface temperature distributions is presented. The method is also shown to be applicable to coupled nuclear radiation and heat conduction problems. DOE

N79-10386# Argonne National Lab., Ill. Components Technology Div.

TWO-PHASE FLOW MEASUREMENT BY RADIOACTIVE TRACER TECHNIQUES

Paul Kehler 1977 18 p refs Presented at the 5th Water Reactor Safety Res. Inform. Meeting, Gaithersburg, Md., 7-11 Nov. 1977
(Contract W-31-109-eng-38)
(CONF-771126-8) Avail: NTIS HC A02/MF A01

Instrumentation systems and techniques for radioactive tracer applications for one-component, two phase flow measurements were developed during the experimental study of the phenomena in the upper reactor plenum reflooding. Methods are also being developed for the calibration of conventional two phase flow measurement systems containing drag disks, turbines, and pressure sensors, by radioactive tracer techniques. DOE

N79-10387# Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.

THE STABILITY OF A TWO LAYER FLOW WITHOUT SHEAR IN THE PRESENCE OF BOUNDARY GENERATED TURBULENCE: FIELD VERIFICATION

Richard H. French and Steven C. McCutcheon Oct. 1977 85 p refs Prepared in cooperation with Tennessee Univ., Knoxville
(Contracts DI-14-34-0001-7089; DI-14-34-0001-7090)
(PB-282595/8; W78-08140; OWRT-A-044-TENN(1); TR-39; RR-60) Avail: NTIS HC A05/MF A01 CSCL 13B

Field data were collected to verify a model defining the stability of density interfaces between fluids of different densities when the turbulence is primarily generated at the bottom boundary. On the basis of an average parameter Richardson number and the Keulegan number density interfaces can be classified as stable, transitional or unstable. The field data support the original hypothesis. GRA

N79-10388# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Nuclear Engineering.

VIRTUAL MASS EFFECTS IN TWO-PHASE FLOW

Lap Yan Cheng, Donald A. Drew, and Richard T. Lahey Mar. 1978 52 p refs
(Contract AT(49-24)-0301)
(PB-279329/7; NUREG-CR-0020) Avail: NTIS HC A04/MF A01 CSCL 20D

The effect of virtual mass on phase separation during the acceleration of a two-phase mixture was studied. Virtual mass can be regarded as an induced inertia on the dispersed phase which is accelerating relative to the continuous phase, and it was found that the virtual mass acceleration is objective, implying an invariance with respect to reference frame. An objective form of the virtual acceleration was derived and required parameters were determined for limiting cases. Analysis determined that experiments on single bubble nozzle/diffuser flow cannot readily discriminate between various virtual mass acceleration models. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N79-10389* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

METHOD OF OBTAINING INTENSIFIED IMAGE FROM DEVELOPED PHOTOGRAPHIC FILMS AND PLATES **Patent**

Barbara S. Askins, inventor (to NASA) Issued 18 Jul. 1978 8 p Filed 9 Jun. 1976 Supersedes N76-26449 (14 - 17, p 2189)
(NASA-Case-MFS-23461-1; US-Patent-4,101,780; US-Patent-Appl-SN-694406; US-Patent-Class-250-475; US-Patent-Class-96-27R; US-Patent-Class-96-60R; US-Patent-Class-252-301.1R; US-Patent-Class-252-301.16) Avail: US Patent Office CSCL 14E

A method is explained of obtaining intensified images from silver images on developed photographic films and plates. The steps involve converting silver of the developed film or plate to a radioactive compound by treatment with an aqueous alkaline solution of an organo-S35 compound; placing the treated film or plate in direct contact with a receiver film which is then exposed by radiation from the activated film; and developing and fixing the resulting intensified image on the receiver film.
Official Gazette of the U.S. Patent Office

N79-10390* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PSEUDO CONTINUOUS WAVE INSTRUMENT **Patent**

Joseph S. Heyman, inventor (to NASA) Issued 3 Oct. 1978 6 p Filed 8 Dec. 1977 Supersedes N78-17821 (16 - 8, p 1078)
(NASA-Case-LAR-12260-1; US-Patent-4,117,731; US-Patent-Class-73-579; US-Patent-Class-73-589) Avail: US Patent Office CSCL 14B

Acoustic properties and their changes in a sample of liquid, gas, plasma or solid are measured by applying a variable frequency source to the sample by means of a transducer to produce sound waves within the sample. The application of the variable frequency source to the sample is periodically interrupted for a short duration. Means are connected to the transducer for receiving the resulting acoustic signals during the interruptions for producing a control signal indicative of a difference in the frequency of the output of the variable frequency source and the frequency of a mechanical resonant peak in the sample. The control signal is applied to the variable frequency source to maintain its output frequency at the frequency of the mechanical resonant peak. The change in frequency of the variable frequency source indicates the shift in frequency of the mechanical resonant peak and the amplitude of the acoustic signals indicates the attenuation of the acoustic signals in the sample.
Official Gazette of the U.S. Patent Office

N79-10391* National Aeronautics and Space Administration. Pasadena Office, Calif.

SURFACE ROUGHNESS MEASURING SYSTEM **Patent**

Atul Jain, inventor (to NASA) (JPL) Issued 18 Jul. 1978 15 p Filed 24 Nov. 1976 Supersedes N77-17325 (15 - 08, p 1020) Sponsored by NASA
(NASA-Case-NPO-13862-1; US-Patent-4,101,891; US-Patent-Appl-SN-744577; US-Patent-Class-343-17.2PC; US-Patent-Class-343-5CM; US-Patent-Class-343-5W; US-Patent-Class-324-77K) Avail: US Patent Office CSCL 14B

Significant height information of ocean waves, or peaks of rough terrain is obtained by compressing the radar signal over different widths of the available chirp or Doppler bandwidths, and cross-correlating one of these images with each of the others. Upon plotting a fixed (e.g., zero) component of the cross-correlation values as the spacing is increased over some empirically

determined range, the system is calibrated. To measure height with the system, a spacing value is selected and a cross-correlation value is determined between two intensity images at a selected frequency spacing. The measured height is the slope of the cross-correlation value used. Both electronic and optical radar signal data compressors and cross-correlations are disclosed for implementation of the system.
Official Gazette of the U.S. Patent Office

N79-10392*# National Aeronautics and Space Administration. Pasadena Office, Calif.
STARK CELL SPECTROPHONE WITH POLARIZATION MODULATION Patent Application
Michael J. Kavaya (JPL) and Jack S. Margolis, inventors (to NASA) (JPL) Filed 29 Sep. 1978 13 p
(Contract NAS7-100)
(NASA-Case-NPO-14362-1; US-Patent-Appl-SN-946995) Avail: NTIS HC A02/MF A01 CSCL 14B

An optoacoustic detector (spectrophone), and more particular a Stark cell spectrophone is presented in which the background noise contributed by the heating effect of the spectrophone windows are to be eliminated. The novelty of the invention resides in rotating the polarization of a laser beam relative to the electric field of a Stark cell spectrophone, or vice versa, in order to modulate absorption for synchronous detection, and thus eliminate heating effects of the laser on the cell windows. NASA

N79-10393*# Itek Corp., Lexington, Mass. Optical Systems Div.
FEASIBILITY STUDY FOR THE APPLICATION OF THE LARGE FORMAT CAMERA AS A PAYLOAD FOR THE ORBITER PROGRAM Final Report
Sep. 1978 195 p
(Contract NAS9-15490)
(NASA-CR-151848; Itek-78-9549A-2-Rev-A) Avail: NTIS HC A09/MF A01 CSCL 14E

The large format camera (LFC) designed as a 30 cm focal length cartographic camera system that employs forward motion compensation in order to achieve the full image resolution provided by its 80 degree field angle lens is described. The feasibility of application of the current LFC design to deployment in the orbiter program as the Orbiter Camera Payload System was assessed and the changes that are necessary to meet such a requirement are discussed. Current design and any proposed design changes were evaluated relative to possible future deployment of the LFC on a free flyer vehicle or in a WB-57F. Preliminary mission interface requirements for the LFC are given. J.M.S.

N79-10394# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GIMBAL CAGING MECHANISM
Cornelius M. Sullivan 16 May 1978 17 p
(Contract F19628-78-C-0002; AF Proj. 649L)
(AD-A056903; TN-1978-19; ESD-TR-78-99) Avail: NTIS HC A02/MF A01 CSCL 13/9

This note describes a mechanism for caging a single-axis gimbal for a satellite application. The caging mechanism consists of two pivoted links that clamp the gimbal shaft in the nominal position. The clamping load is produced by a double toggle mechanism. A nonreusable actuator releases the mechanism on command; a caging override permits unlimited manual release.
Author (GRA)

N79-10395# Harry Diamond Labs., Adelphi, Md.
TEMPERATURE SENSING USING LINEAR AND NONLINEAR RESISTIVE FLUIDIC COMPONENTS
George Mon Jun. 1978 19 p
(AD-A057205; HDL-TM-78-6) Avail: NTIS HC A02/MF A01 CSCL 14/2

A fluidic temperature sensor using linear and nonlinear resistive elements has been designed and tested. The sensor output is independent of the geometries (if identical resistances are used), depending only on the fluid properties and the supply pressure. Theoretical calculations indicate that this sensor has a very good sensitivity throughout the temperature range between 20 and 1000 C and the preliminary test results are in good agreement with the theoretical predictions. Author (GRA)

N79-10396# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
RESISTIVE WIRE PROBE USING A THIN WALL TUBE
C. A. Campos Mar. 1978 15 p refs
(Contract EY-76-C-04-0489)
(MHSMP-78-10) Avail: NTIS HC A02/MF A01

A No. 40 B and S resistive wire which is partially insulated by a skip-wound nylon thread is shown to be sensitive to varying high explosive shock variations. Shot-to-shot comparisons and detonation velocity measurements made with both steak camera and timing switches are described. Results from a differentiating operational amplifier are compared to results obtained by mathematically differentiating the same record by use of a computer. DOE

N79-10397# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho. National Engineering Lab.
PRINCIPLES OF OPERATION AND DATA REDUCTION TECHNIQUES FOR THE LOFT DRAG DISC TURBINE TRANSDUCER
S. Silverman Sep. 1977 157 p refs
(Contract EY-76-C-07-1570)
(TREE-NUREG-1109) Avail: NTIS HC A08/MF A01

An analysis of the single- and two-phase flow data applicable to the loss-of-fluid test (LOFT) is presented for the LOFT drag turbine transducer. Analytical models which were employed to correlate the experimental data are presented. DOE

N79-10398# California Univ., Berkeley. Operations Research Center.
MODELS AND ERROR ANALYSES OF MEASURING INSTRUMENTS: NUMERICAL APPLICATIONS
E. Sundararajan Dattatreya Sep. 1977 20 p refs
(Contract W-7405-eng-48)
(UCRL-13733-4; ORC-77-24) Avail: NTIS HC A02/MF A01

Error models of the basic measurement instruments used in nuclear accountability illustrating the error variances of various measurements are described. The estimation of plutonium in a reprocessing plant using bubblers, coulometers, calorimeters, titration apparatus, and mass spectrometers is explained. DOE

N79-10399# National Technical Information Service, Springfield, Va.
HOT WIRE ANEMOMETRY, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1971 - Jul. 1978
Guy E. Habercom, Jr. Aug. 1978 207 p Supersedes NTIS/PS-77/0782; NTIS/PS-76/0732; NTIS/PS-75/663 (NTIS/PS-78/0882/7; NTIS/PS-77/0782; NTIS/PS-76/0732; NTIS/PS-75/663) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

Citations include principles; calibrating; circuit diagrams; flow measurement; hypersonic, supersonic, transonic, and subsonic characteristics; boundary layer studies; turbulence; jet, pipe, and tunnel flow; mathematical models; wind tunnel model tests, airport structure simulation; mass transfer and flow stability; probe modifications; flow about geometric forms; flow patterns; and related topics. GRA

N79-10400# National Technical Information Service, Springfield, Va.
HOT FILM ANEMOMETRY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978
Guy E. Habercom, Jr. Aug. 1978 58 p Supersedes NTIS/PS-77/0783; NTIS/PS-76/0731; NTIS/PS-75/664 (NTIS/PS-78/0879/3; NTIS/PS-77/0783; NTIS/PS-76/0731; NTIS/PS-75/664) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

A bibliography containing 51 abstracts concerning the principles of hot film anemometer operation are summarized. Wind tunnel and laboratory tests are described. Flow field dynamics are discussed involving turbulence, boundary layers, separation, shock waves, and stresses. Mathematical models and analysis are presented and computer techniques are outlined.
GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N79-10401 California Inst. of Tech., Pasadena.
APERIODIC STRUCTURES IN OPTICS AND INTEGRATED OPTICS AND THE TRANSVERSE BRAGG REFLECTOR Ph.D. Thesis
Jeffrey Brian Shellan 1978 240 p
Avail: Univ. Microfilms Order No. 7815214

Devices were designed, fabricated, tested and analyzed which make use of chirped grating corrugation on the surface of a dielectric waveguide. These structures can be used as input-output couplers, multiplexers and demultiplexers, and broad band filters. The effects of a random statistical variation in the thickness of layers in dielectric mirror on its reflectivity properties were evaluated. The aperiodicity in Bragg reflector mirrors is unintentional and is present to some extent in all devices made. Transverse Bragg reflector lasers confine light normal to the junction plane in the active region, through reflection from an adjacent layered medium. Dissert. Abstr.

N79-10402 Texas Univ. at Austin.
ENTROPY, STABILITY AND FLUCTUATIONS IN LASING SYSTEMS Ph.D. Thesis
Adi Ratan Bulsara 1978 227 p
Avail: Univ. Microfilms Order No. 7817622

The theory of the generalized entropy derived by Prigogine and co-workers postulates the existence of a quadratic Liapounov function which may be used to prove the asymptotic stability of a dynamic steady state. For an open system, the definition of the entropy must be modified to include an entropy flow. The resulting entropy production is a Liapounov function for a near-equilibrium steady state and in fact, is a minimum in this case. The above considerations are applied here to simple laser models, these being examples of open systems far from equilibrium. Dissert. Abstr.

N79-10403*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TEMPERATURE DEPENDENCE OF OPTICALLY DUMPED FAR-INFRARED (FIR) LASER OUTPUT POWER
Nabil M. Lawandy Oct. 1978 23 p refs Submitted for publication
(NASA-TM-78080; G-7802-14) Avail: NTIS HC A02/MF A01 CSCL 20E

The temperature dependence of the small signal gain and saturation power are derived using temperature-dependent rates in a four-level model. An expression is developed for the output power of a far-infrared oscillator as a function of temperature for both fixed pressure and fixed density. The results are valid in the regime of homogeneous broadening of the rotational transition and Doppler broadening of the pump transition. It is shown that, for most lasers, both the small signal gain and the saturation power decrease with increasing temperature. These effects have the overall result of increasing output power with decreasing temperatures. Author

N79-10404# Ballistic Research Labs., Aberdeen Proving Ground, Md.
LASER-INDUCED OPTO-ACOUSTIC PULSES IN A FLAME
David R. Crosley Jun. 1978 15 p refs
(AD-A056425) Avail: NTIS HC A02/MF A01 CSCL 21/2

Another means of detection of the absorption of laser radiation by individual species in a flame environment is the production of opto-acoustic pulses in a flame at 1-atm pressure. The flame is seeded with alkali atoms and a pulsed laser is tuned to the appropriate absorption line. While some of the electronically excited atoms fluoresce, the vast majority lose their energy by collision with other gases present in the flame. This energy ultimately (though rapidly) is converted into translational kinetic energy of the flame gases, producing a pulsed pressure wave which expands from the region illuminated by the laser. This sound wave is readily audible to an observer in the vicinity of the burner. Quantitative measurements are made using a microphone, and show that the technique is very sensitive and accurate, and perturbs neither the gas dynamics nor chemical kinetics of the flame. GRA

N79-10405# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
DESIGN AND EVALUATION OF A FACILITY TO STUDY TWO-DIMENSIONAL SUPERSONIC AIR-HELIUM MIXING Final Report
John D. Carlile Mar. 1978 47 p refs
(AD-A056937; AFIT-GAE/AA/78M-4) Avail: NTIS HC A03/MF A01 CSCL 20/5

A facility to study two-dimensional supersonic air-helium mixing in a gas dynamic laser cavity was designed, constructed, and evaluated. The flow field may be analyzed via static and total pressure measurements, gas mixture samples, and schlieren photography. The multiple nozzle test section consisted of Mach 3.0 air nozzles alternated with Mach 3.0 helium nozzles exhausted into an instrumented test cavity. Pressure was maintained in the cavity by two alternate methods; simple diffusers exhausted to atmospheric conditions, and exhausting the cavity into a group of evacuated air tanks. Both methods gave similar cavity flow fields as indicated by schlieren photography and static pressure measurements. Gas samples and pressure measurements were taken with a series of small diameter probes and automatically timed solenoid valves. Gas samples were not analyzed in this study. Nozzle exit plane Mach numbers were calculated from pressure measurements and verified with schlieren photographs of a wedge inserted into the flow. The apparatus has low helium consumption and yields accurate, repeatable pressure measurements. The facility is to be used for a subsequent complete flow field analysis. Author (GRA)

N79-10406# Air Force Geophysics Lab., Hanscom AFB, Mass.
ATMOSPHERIC TRANSMISSION OF LASER RADIATION: COMPUTER CODE LASER Environmental Research Papers
R. A. McClatchey and A. P. DAgati 31 Jan. 1978 140 p refs
(AD-A056659; AFGL-TR-78-0029; AFGL-ERP-622) Avail: NTIS HC A07/MF A01 CSCL 04/1

A computer code called LASER has been developed and documented and will be made available to interested users. LASER is a version of HITRAN which computes the monochromatic extinction coefficients for both molecular and particulate components of the atmosphere and provides results for a series of atmospheric models from sea level to 100 km in altitude. A detailed description of the calculations leading to these extinction coefficient charts is provided, and charts are provided for a number of specific laser frequencies in order to bring up to date previously published results. In addition, high spectral resolution atmospheric transmission spectra have been provided covering the regions of CO2, CO, and DF laser emission. These plotted spectra represent an up-to-date version of previously published material. Author (GRA)

N79-10407# Avco-Everett Research Lab., Everett, Mass.
INVESTIGATION OF LASER PROPULSION, VOLUME 2 Final Technical Report, 1 Mar. 1976 - 15 Nov. 1977
P. K. Chapman, D. H. Douglas-Hamilton, H. Legner, D. A. Reilly, and G. Weyl Nov. 1977 265 p refs
(Contract N00014-76-C-0646; DARPA Order 3138)
(AD-A056748) Avail: NTIS HC A12/MF A01 CSCL 21/8

The use of large ground based lasers to radiate power into a rocket engine allows arbitrary choice of propellant and specific impulse. The case of launch of one ton payload from near ground to geosynchronous transfer ellipse appears to be feasible using stacked carbon dioxide repetitive pulse lasers. Atmospheric propagation is enhanced by bleaching out CO2 absorption and using phase correction of the thermal blooming generated it is expected that 1 microradian beam spreading can be achieved. The use of pulsed lasers permits an engine based on the laser detonation wave, in which laser energy is efficiently absorbed by inverse Bremsstrahlung in the propellant, which then expands out of the engine and provides thrust. Continuous use costs in the order of $20/lb to GEO are anticipated. Author (GRA)

N79-10408# Columbia Univ., New York. Radiation Lab.
RESEARCH INVESTIGATION DIRECTED TOWARD EX-

TENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Interim Progress Report, 1 Apr. 1977 - 31 Mar. 1978
William Happer 31 Mar. 1978 357 p refs
(Contract DAAG29-77-C-0019; Grant DAAG29-77-G-0015; DA Proj. 1L1-611-BH-57)
(AD-A056767; IPR-28) Avail: NTIS HC A16/MF A01 CSCL 07/4

A method has been developed which provides a complete description of the energy and population distributions in a laser pumped, metastable polyatomic molecule. Different temperatures are required for each mode and for the translational/rotational degrees of freedom. Good agreement between calculated and measured distributions has been found for CH3F. Vibrational energy for this system tends to accumulate preferentially in the nu 3 C-F stretch vibrational mode. As a result, extremely large population inversions are predicted for CH3F when optically pumped by a CO2 laser. These results are expected to apply to many polyatomic molecules. GRA

N79-10409# Army Materials and Mechanics Research Center, Watertown, Mass.
LASER RODS FABRICATED FROM AMMRC GROWN ND: YAG
Jaroslav L. Caslavsky and Dennis J. Viechnicki Jun. 1978 13 p refs
(AD-A056419) Avail: NTIS HC A02/MF A01 CSCL 20/5

The laser will be used extensively on the modern battlefield to greatly improve the accuracy of new Army weapon systems. Some examples of applications are laser range finders in the XM-1 tank and other armored vehicles and laser target designators for infrared guided missiles and projectiles such as HELLFIRE and COPPERHEAD. While lasing ability is found in gases, liquids, and solids (both crystalline and noncrystalline), the laser preferred in the above Army application, because of its high efficiency and narrow spectral linewidth, is a single crystal of a compound of yttrium oxide and aluminum oxide with small additions of neodymium oxide as the active element. GRA

N79-10410# Army Missile Research and Development Command, Redstone Arsenal, Ala.
MIRADCOM PROGRAM IN SWEPT-GAIN SUPERRADIANCE
David W. Howgate, Charles M. Bowden, and John J. Ehrlich Jun. 1978 13 p refs
(AD-A056449) Avail: NTIS HC A02/MF A01 CSCL 20/5

Recently, Bonifacio, Hopf, Meystre and Scully, using amplifier theory, predicted that under certain conditions, a noise amplifier, pumped by an impulse excitation traveling at the speed of light in the active material, can produce highly nonlinear spacially asymptotic coherent pulses of electromagnetic energy of anomalous intensity and of anomalously short temporal width. The pulse intensities were predicted to increase as the square of the density of the active material, whereas the temporal width should decrease as the inverse of the density. Also, the pulses are characterized by a temporal delay from the pump cutoff to the peak of the pulse evolution. This process has come to be known as swept-gain superradiance. Electromagnetic energy having these general characteristics would be useful in application to LADAR systems for propagation, ranging, discrimination and coherent imaging. Other applications would include coupling to plasmas for efficient energy delivery needed for laser induced fusion and for plasma diagnostics. Since the pulses are produced in the amplifier configuration without mirrors, this presents an attractive scheme for production of unidirectional coherent VUV and X-ray radiation. GRA

N79-10411# Vanderbilt Univ., Nashville, Tenn. Dept. of Chemistry.
ULTRAVIOLET LASING TRANSITIONS IN DIATOMIC MOLECULES Interim Progress Report
Joel Tellinghuisen Jul. 1978 23 p refs
(Contract N00014-76-C-0450; DARPA Order 2840)
(AD-A056834) Avail: NTIS HC A02/MF A01 CSCL 20/5

The work is primarily directed toward a better spectroscopic understanding of UV laser transitions in selected diatomic molecules. Specifically the work emphasizes the analysis of spectroscopic data for discrete (bound-bound) and diffuse (bound-free) transitions in the rare gas monohalide (AX) molecules, and discrete transitions in the homonuclear halogens. The primary aims of the work are a specific, detailed identification of the laser transitions, including a description of the electronic, and (fore discrete systems) vibrational and rotational states involved in the transitions; determination of potential curves for relevant electronic states; calculation of intensity factors - Franck-Condon factors and R-centroids for discrete systems, Franck-Condon densities and stimulated emission cross sections for diffuse systems; evaluation of vibrational relaxation rates in the excited states from the pressure dependence of the emission spectrum; and in some cases (XeF, I2, Br2) a determination of the kinetics of production and removal of the lower or terminal state of the laser transition. These studies are of relevance to the better understanding of these new lasers and to the development of more complete and correct mathematical models for describing and predicting their performance. GRA

N79-10412# SRI International Corp., Menlo Park, Calif.
NEW ELECTRONIC TRANSITION LASER SYSTEMS Technical Report, 17 Feb. - 17 Aug. 1977
D. L. Huestis, R. M. Hill, D. J. Eckstrom, M. V. McCusker, and D. C. Lorents May 1978 243 p refs
(Contract DASG60-77-C-0028; ARPA Order 3323)
(AD-A056810; SRI-MP-78-07; TR-1) Avail: NTIS HC A11/MF A01 CSCL 20/5

This report describes our research program directed toward the identification of new high-performance electronic transition lasers, and toward the detailed characterization of these laser media. An extensive theoretical and experimental survey has been conducted, emphasizing molecules whose excited states are ionic in character. Several promising new candidates have been identified; the laser potential of some of these has been investigated in detail (ICl, RgHg, and HgCl); others should be the subjects of further investigation (e.g., the cadmium and zinc halides). Perhaps the most important accomplishment reported here is the demonstration (in collaboration with Maxwell Laboratories Inc.) of an electron-beam-controlled-discharge HgCl laser. This report describes the experimental studies which led to this achievement, and points out several areas in which further research is needed. Considerable progress has been made in characterizing the microscopic processes which dominate the performance of electron-beam pumped XeF lasers. The rate of the removal of the lower laser level by collision-induced dissociation has been calculated, and the importance of this process emphasized. GRA

N79-10413# Army Electronics Research and Development Command, Fort Monmouth, N. J.
THERMAL BLOOMING AND AIR BREAKDOWN INTERACTION FOR PULSED HIGH ENERGY LASERS
Robert S. Rohde and Rudolf G. Buser Jun. 1978 13 p refs
(AD-A056480) Avail: NTIS HC A02/MF A01 CSCL 20/5

An experiment has been performed combining the effects of short-time thermal blooming and air breakdown. The experiments demonstrate that, for the cases investigated, total energy transfer is higher for breakdown with blooming than without. Energy increases up to 50% have been experimentally observed. Breakdown processes are highly sensitive to the thermal blooming structure, and the combination of both effects must be taken into account if optimum energy delivery to the target is to be achieved. GRA

N79-10414# Georgia Inst. of Tech., Atlanta. School of Physics.
IONIC TRANSPORT AND COLLISION PROCESSES IN LASER GASES Final Report, 1 Jun. 1974 - 14 Jun. 1978
E. W. McDaniel 1 Jul. 1978 8 p
(Grant DAHC04-74-G-0192; DAAG29-77-G-0171)
(AD-A056393; ARO-12134.3-P) Avail: NTIS HC A02/MF A01 CSCL 07/4

The first phase of the research involved a study of positive and negative ions in carbon dioxide gas. The identities of the ions produced in CO2 by electron bombardment were ascertained, and the conversion of these ions to other types by ion-molecule reactions was studied. The mobilities of various species were measured. In the second phase, the mobilities and longitudinal diffusion coefficents of positive alkali and negative halogen ions

in the noble gases were measured. Interaction potentials were determined from the mobility data. Author (GRA)

N79-10415# California Univ., Livermore. Lawrence Livermore Lab.
REVIEW OF PHOTO-PUMPED SHORT WAVELENGTH LASERS
P. L. Hagelstein Oct. 1977 74 p refs
(Contract W-7405-eng-48)
(UCID-17629) Avail: NTIS HC A04/MF A01

Thirteen papers dated from 1967 to 1977 on photoionization pumped laser schemes and eight papers dated from 1974 to 1977 on schemes involving photoionization and photoexcitation are reviewed. DOE

N79-10416# National Technical Information Service, Springfield, Va.
LASER CUTTING AND MACHINING: METALS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1978
Guy E. Habercom, Jr. Aug. 1978 282 p Supersedes NTIS/PS-77/0722
(NTIS/PS-78/0852; NTIS/PS-77/0722) Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Techniques for metalworking, machining, and cutting by use of controlled laser beams are investigated in these reports gathered in world-wide literature surveys. Precision finishing of metal surfaces is described. The thermal response of various metals is evaluated. This updated bibliography contains 275 abstracts, 41 of which are new entries to the previous edition. GRA

N79-10417# National Technical Information Service, Springfield, Va.
LASER CUTTING AND MACHINING: NONMETALS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1978
Guy E. Habercom, Jr. Aug. 1978 122 p Supersedes NTIS/PS-77/0723
(NTIS/PS-78/0853/8; NTIS/PS-77/0723) Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Techniques for electrothermal cutting and machining of glass, fabrics, wood, plastics, and other nonmetal products by use of controlled laser beams are described in these reports gathered in world-wide literature surveys. Thermal analyses of materials exposed to laser beams are investigated. This updated bibliography contains 115 abstracts, 21 of which are new entries to the previous edition. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N79-10418* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CANTILEVER MOUNTED RESILIENT PAD GAS BEARING Patent
Izhak Etsion, inventor (to NASA) (NAS-NRC, Washington, D.C.) Issued 11 Jul. 1978 6 p Filed 28 Apr. 1977 Supersedes N77-24496 (15 - 15, p 1998) Sponsored by NASA
(NASA-Case-LEW-12569-1; US-Patent-4,099,799;
US-Patent-Appl-SN-792069; US-Patent-Class-308-5R;
US-Patent-Class-308-9; US-Patent-Class-308-121;
US-Patent-Class-308-160; US-Patent-Class-308-163;
US-Patent-Class-308-172; US-Patent-Class-308-DIG.1) Avail: US Patent Office CSCL 11A

A gas-lubricated bearing is described, employing at least one pad mounted on a rectangular cantilever beam to produce a lubricating wedge between the face of the pad and a moving surface. The load-carrying and stiffness characteristics of the pad are related to the dimensions and modulus of elasticity of the beam. The bearing is applicable to a wide variety of types of hydrodynamic bearings. Official Gazette of the U.S. Patent Office

N79-10419* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
WIRE STRIPPER Patent
Merle A. Economu, inventor (to NASA) Issued 3 Oct. 1978 5 p Filed 9 Aug. 1976
(NASA-Case-FRC-10111-1; US-Patent-4,117,749;
US-Patent-Appl-SN-713027; US-Patent-Class-81-9.5R;
US-Patent-Class-30-90.6) Avail: US Patent Office CSCL 13I

An insulation stripper is described which is especially useful for shielded wire, the stripper including a first pair of jaws with blades extending substantially perpendicular to the axis of the wire, and a second pair of jaws with blades extending substantially parallel to the axis of the wire. The first pair of jaws is pressed against the wire so the blades cut into the insulation, and the device is turned to form circumferential cuts in the insulation. Then the second pair of jaws is pressed against the wire so the blades cut into the insulation, and the wire is moved through the device to form longitudinal cuts that permit easy removal of the insulation. Each of the blades is located within the concave face of a V-block, to center the blades on the wire and to limit the depth of blade penetration.
Official Gazette of the U.S. Patent Office

N79-10420* National Aeronautics and Space Administration. Pasadena Office, Calif.
VEHICULAR IMPACT ABSORPTION SYSTEM Patent
Albert C. Knoell (JPL) and Abraham H. Wilson, inventors (to NASA) (JPL) Issued 3 Oct. 1978 5 p Filed 19 Aug. 1977 Supersedes N77-31501 (15 - 22, p 2946) Sponsored by NASA
(NASA-Case-NPO-14014-1; US-Patent-4,118,014;
US-Patent-Appl-SN-826204; US-Patent-Class-256-1;
US-Patent-Class-188-1C; US-Patent-Class-256-13.1) Avail: US Patent Office CSCL 13F

An improved vehicular impact absorption system characterized by a plurality of aligned crash cushions of substantially cubic configuration is described. Each consists of a plurality of voided aluminum beverage cans arranged in substantial parallelism within a plurality of superimposed tiers and a covering envelope formed of metal hardware cloth. A plurality of cables is extended through the cushions in substantial parallelism with an axis of alignment for the cushions adapted to be anchored at each of the opposite end thereof. Official Gazette of the U.S. Patent Office

N79-10421* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPUTERIZED SYSTEM FOR TRANSLATING A TORCH HEAD Patent
William A. Wall, Jr. (SCI Systems, Inc., Huntsville, Al.), Robert E. Ives (SCI Systems, Inc., Huntsville, Al.), Miles Melvin Bruce, Jr. (SCI Systems, Inc., Huntsville, Al.), Peter Paul Pryor, Jr. (SCI Systems, Inc., Huntsville, Al.), and Leslie H. Gard, inventors (to NASA) (SCI Systems, Inc., Huntsville, Al.) Issued 3 Oct. 1978 11 p Filed 20 May 1977 Supersedes N77-24497 (15 - 15, p 1998)
(NASA-Case-MFS-23620-1; US-Patent-4,118,620;
US-Patent-Appl-SN-799023; US-Patent-Class-219-124.32;
US-Patent-Class-219-124.2-2; US-Patent-Class-219-125.1;
US-Patent-Class-228-8) Avail: US Patent Office CSCL 13I

The system provides a constant travel speed along a contoured workpiece. It has a driven skate characterized by an elongated bed, with a pair of independently pivoted trucks connected to the bed for support. The trucks are mounted on a contoured track of arbitrary configuration in a mutually spaced relation. An axially extensible torch head manipulator arm is mounted on the bed of the carriage and projects perpendicular from the midportion. The torch head is mounted at its distal end. A real-time computerized control drive subsystem is used to advance the skate along the track of a variable rate for maintaining a constant speed for the torch head tip, and to position the torch axis relative to a preset angle to the workpiece.
Official Gazette of the U.S. Patent Office

N79-10422* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ROTATABLE MASS FOR A FLYWHEEL Patent
George M. Weyler, Jr., inventor (to NASA) Issued 4 Jul. 1978 4 p Filed 14 Nov. 1975 Supersedes N76-13500 (14 - 04, p 0459)
(NASA-Case-MFS-23051-1; US-Patent-4,098,142;

US-Patent-Appl-SN-632111; US-Patent-Class-74-572; US-Patent-Class-15-230.16; US-Patent-Class-15-230.17; US-Patent-Class-29-125; US-Patent-Class-428-133) Avail: US Patent Office CSCL 13I

An improved rotable mass for a flywheel characterized by a plurality of coaxially aligned, contiguous disks mounted on a spin shaft is presented. Each disk of the plurality is formed by a plurality of woven fibers disposed in a plane transversely related to an axis of rotation with the fibers of alternate disks being continuous throughout their length. The mid-portion of the fibers of the remaining disks of the plurality is removed for defining annular voids concentrically related to the spin shaft.

Official Gazette of the U.S. Patent Office

N79-10423*# Avco Lycoming Div., Stratford, Conn.

TRANSMISSION SEAL DEVELOPMENT Final Report, 1 Jul. 1976 - 30 Apr. 1977

Michael Brien Oct. 1977 41 p refs Sponsored in part by USAAMRDC

(Contract NAS3-20045)

(NASA-CR-135372; LYC-77-65) Avail: NTIS HC A03/MF A01 CSCL 11A

An experimental evaluation was performed on a high-speed (72.9 m/s, 14,349 ft/min) transmission seal of the synergistic type. During testing of the seal, oil leakage occurred at positive bearing cavity pressures. Modifications were made in an attempt to eliminate the leakage but none were completely successful. Leakage appears to be the result of questionable positioning of the sealing elements resulting in inadequate shaft contact by the oil side sealing element. This condition may be related to the nonsymmetrical shape of the elastomeric retainer and to dimensional changes caused by swelling of the elastomeric retainer from exposure to the sealed fluid. Indications of a speed dependent leakage characteristic were also observed. Author

N79-10424*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPRESSIBLE FLOW ACROSS NARROW PASSAGES: COMPARISON OF THEORY AND EXPERIMENT FOR FACE SEALS

Gordon P. Allen, Donald W. Wisander, and William F. Hady Nov. 1978 19 p refs

(NASA-TP-1346; E-9120) Avail: NTIS HC A02/MF A01 CSCL 11A

Computer calculation for determining compressible flow across radial face seals were compared with measured results obtained in a seal simulator rig at pressure ratios to 0.9 (ambient pressure/sealed pressure). In general, the measured and calculated leakages across the seal dam agreed within 3 percent. The resultant loss coefficient, dependent upon the pressure ratio, ranged from 0.47 to 0.68. The calculated pressures were within 2.5 N/cu um of the measured values. G.G.

N79-10425*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANISOTROPIC FRICTION AND WEAR OF SINGLE-CRYSTAL

Kazuhisa Miyoshi (Kanazawa Univ., Japan) and Donald H. Buckley Oct. 1978 23 p refs

(NASA-TP-1339; E-9673) Avail: NTIS HC A02/MF A01 CSCL 20L

Sliding friction experiments were conducted with manganese-zinc ferrite (100), (110), (111), and (211) planes in contact with themselves. Mating the highest-atomic-density directions, (110), of matched crystallographic planes resulted in the lowest coefficients of friction. Mating matched (same) high-atomic-density planes and matched (same)crystallographic directions resulted in low coefficients of friction. Mating dissimilar crystallographic planes, however, did not give significantly different friction results from those with matched planes. Sliding caused cracking and the formation of hexagonal- and rectangular-platelet wear debris on ferrite surfaces, primarily from cleavage of the (110) planes. Author

N79-10426*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FREE-PISTON REGENERATIVE HOT GAS HYDRAULIC ENGINE Patent Application

Donald G. Beremand, inventor (to NASA) Filed 12 Oct. 1978 21 p

(NASA-Case-LEW-12274-1; US-Patent-Appl-SN-950876) Avail: NTIS HC A02/MF A01 CSCL 13I

A free piston, regenerative, hydraulic engine is described, including displacer piston which is driven by a high pressure or low pressure gas. Actuation of the displacer piston circulates the working fluid through a heater, a regenerator, and a cooler. This invention includes an inertial mass, such as a piston or a hydraulic fluid column to effectively store and supply energy during portions of the cycle. Power is transmitted from the working fluid to a hydraulic fluid across a diaphragm or lightweight piston to achieve a hydraulic power output. The displacer piston may be driven pneumatically, hydraulically, or electromagnetically. The displacer piston and the inertial mass may be positioned on the same side of the diaphragm member or may be separated by the diaphragm member. NASA

N79-10427*# National Aeronautics and Space Administration. Pasadena Office, Calif.

A QUARTZ BALL VALUE Patent Application

William M. Ingle (Motorola, Inc., Phoenix, Ariz.) and Carl Goetz, inventors (to NASA) (Motorola, Inc., Phoenix, Ariz.) Filed 31 Aug. 1978 12 p

(Contract NAS7-100)

(NASA-Case-NPO-14473-1; US-Patent-Appl-SN-938300) Avail: NTIS HC A02/MF A01 CSCL 13K

A ball value is described, particularly suited for use in the handling of highly corrosive fluids. This item is characterized by: (1) a valve housing formed of communicating segments of quartz tubing; (2) a pair of communicating sockets disposed in coaxial alignment with selected segments of tubing for establishing a pair of inlet ports; (3) a ball formed of quartz material supported for displacement between the sockets; and (4) a valve actuator with a rod attached to the ball for selectively displacing the ball relative to each of the sockets for controlling fluid flow through the inlet ports. NASA

N79-10428# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

EVALUATION OF POLYETHYLENE VERSUS ALUMINUM ALLOY CLOSURES FOR HYDRAULIC COMPONENTS Final Report

A. J. Russo 1 Mar. 1978 12 p

(AD-A056932; NADC-78027-60) Avail: NTIS HC A02/MF A01 CSCL 13/5

Polyethylene and aluminum closures for use on lip-seal type hydraulic fittings during shipment, storage and handling were evaluated. Both types of closures were assembled repeatedly to determine the amount of contaminant generated by the closures and to evaluate the closures for thread chipping, shredding and stripping. The results of the evaluation indicated that closures of both polyethylene and aluminum generated essentially the same contamination and were not subject to degradation after repeated assembly. Author (GRA)

N79-10429# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

DEPTH AND MOTION PREDICTION FOR EARTH PENETRATORS Final Report, Oct. 1977 - Jan. 1978

Robert S. Bernard Jun. 1978 31 p refs

(AD-A056701; WES-TR-S-78-4) Avail: NTIS HC A03/MF A01 CSCL 19/1

Empirical equations of motion have been developed for projectile penetration in soil and rock. The soil penetration analysis uses Young's S-number as the penetrability index. The rock penetration analysis calculates resistance-to-penetration using density, strength, and Rock Quality Designation. Closed-form equations are obtained for final penetration depth in single-layer targets of soil or rock. Numerical solutions are obtained for multiple-layer targets. For targets with accurately known properties, the final-depth results are accurate within - or - 20 percent. Author (GRA)

N79-10430# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.

ANALYSIS OF BEARING DEPOSITS Final Report

Roger W. Phillips and L. U. Tolentino 31 Oct. 1977 44 p refs

(Contract F04701-77-C-0078)
(AD-A056908; TR-0078(3403-02)-2; SAMSO-TR-78-27) Avail: NTIS HC A03/MF A01 CSCL 13/9

Deposits found in life-tested bearing assemblies were analyzed by electron spectroscopy for chemical analysis, by ion microprobe mass spectrometry, by infrared spectroscopy and by solvent analyses. These analyses showed the deposits to be one or more of the following compounds: ferric oxide, naphthenic acid, lead naphthenate, Apiezon C and alkali metal oxides or sulfates. On one of the bearings, the residue on the balls was of a different composition than that found in the raceways.
Author (GRA)

N79-10431# Mechanical Technology, Inc., Latham, N. Y.
ROLLING ELEMENT BEARING AND LUBRICANT TECHNOLOGY PROGRAM. PART 1: PREDICTION OF TORQUE IN DMA BEARINGS Interim Report, Mar. - Sep. 1977
Pradeep K. Gupta Dec. 1977 47 p refs
(Contract F33615-77-C-5100)
(AD-A056398; MTI-78TR7-Pt-1; AFML-TR-77-229-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 13/9

Analytical simulations of the dynamic performance of a DMA ball bearing are obtained under a range of operting conditions. The predicted torques with Coulomb type friction characteristics seem to be within the range of the experimentally observed torque values. Also there is a general agreement between the observed torque dependence on speed and the trends predicted by the analytical simulations. A systematic parametric study over the various possible traction models covering both elastohydrodynamic and boundary friction regimes suggests that the test DMA bearing works more in the boundary friction domain or perhaps a mixed regime.
Author (GRA)

N79-10432# Sandia Labs., Livermore, Calif.
MICROPROCESSOR-CONTROLLER BEAM DEFLECTION SYSTEM FOR THE HAMILTON STANDARD W2 ELECTRON BEAM WELDER
J. Hopwood May 1978 116 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8012) Avail: NTIS HC A06/MF A01

Operational, programming, and circuit details are given for a system designed for preprogrammed controlled movement of the electron beam within the Hamilton standard welding chamber. The system is comprised of two parts, each of which is microprocessor controlled. The desired beam pattern is first drawn on a 20-in. x 20-in. piece of paper and then digitized. Beam rate of travel and dwell time at each point in the pattern are added. The digitized data are processed by part 1 and stored in a portable memory. The memory is inserted in part 2, which is interfaced to the welder. Subsequent controlled movement of the beam takes place. An infinite variety of beam deflection patterns is thus possible. The memory data can be recorded onto magnetic tape for later use. A magnetic tape can be generated by computer program, so that part 2 can be used when part 1 is not available.
DOE

N79-10433# Argonne National Lab., Ill.
PRESSURE TRANSIENT ANALYSIS IN PIPING SYSTEMS INCLUDING THE EFFECTS OF PLASTIC DEFORMATION AND CAVITATION
C. K. Youngdahl, C. A. Kot, and R. A. Valentin Mar. 1978 40 p refs
(Contract W-31-109-eng-38)
(ANL-CT-78-24) Avail: NTIS HC A03/MF A01

Computational methods for analyzing pressure transients in the intermediate heat transport system of a sodium-cooled breeder reactor are being developed. The pressure pulses produced by a sodium/water reaction may plastically deform sections of the piping, and rarefraction waves, because of the low operating pressure, may produce cavitation in the system. The computer program PTA-1, which includes the effect of plastic deformation of piping, and the computer program PTAC, which includes the effect of cavitation, have been previously validated. A new program, PTA-2, is being developed which combines the capabilities of PTA-1 and PTAC.
DOE

N79-10434# Atomics International Div., Golden, Colo. Rocky Flats Plant.
EVALUATION OF PLASMA ARC WELDING CAPABILITIES AND APPLICATIONS
G. S. Mills 31 May 1978 14 p refs
(Contract EY-76-C-4-3533)
(RFP-2722) Avail: NTIS HC A02/MF A01

Unique capabilities of plasma arc welding in the keyhold mode are described, and the potential applicability of these capabilities to Rocky Flats production needs are evaluated. For the area of potential benefits studied, the benefits of this welding technique either did not materialize or the complication of implementing the process in production was not warranted by the demonstrated benefits.
DOE

N79-10435# Sandia Labs., Livermore, Calif.
VARIABLE-DISPLACEMENT SPARK-IGNITION ENGINE Final Report
H. N. Pouliot, C. W. Robinson, and W. R. Delameter May 1978 102 p refs
(Contract EY-76-C-04-0789)
(SAND-77-8299) Avail: NTIS HC A06/MF A01

A five-cylinder variable displacement research engine was designed, built, and tested. Displacement was varied by changing the piston stroke using a four-bar linkage. Before the engine was built, its dynamics were thoroughly analyzed, and a five-cylinder configuration was selected to minimize vibration. Test data show that brake specific fuel consumption is less dependent on load than in conventional engines, and averages less than 0.5 lb/bhp-hr over the load and speed range of ordinary automobile operation. The impact of exhaust gas recirculation on emissions levels was studied experimentally. Several methods for estimating urban fuel economy from dynamometer data predict a 20% to 25% improvement compared with conventional engines at the same emissions levels.
DOE

N79-10436# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
CLAYTON DYNAMOMETER-TO-ROAD TIRE ROLLING RESISTANCE RELATIONSHIP
Richard N. Burgeson Apr. 1978 15 p refs
(PB-281638/7; LDTP-78-09) Avail: NTIS HC A02/MF A01 CSCL 13F

The rolling resistance at 45 PSI as measured on the Clayton Dynamometer is compared with tire rolling resistance data at 26 PSI as measured on the single large-roll dynamometer and corrected for roll curvature. It is concluded that for vehicles equipped with radial tires inflated to pressures of approximately 30 PSI, two tires at 45 PSI on the Clayton are equivalent to four tires (at 30 PSI) on the road; and the Clayton Dynamometer underloads vehicles equipped with bias belted and bias ply tires.
GRA

N79-10437# Rochester Univ., N. Y. Production Automation Project.
GEOMETRIC MODELLING OF MECHANICAL PARTS AND PROCESSES
Herbert B. Voelcker and Aristides A. G. Requicha Oct. 1977 37 p refs
(Grants NSF GI-34274; NSF AP-76-01034)
(PB-281578/5; TM-23; NSF/RA-770475) Avail: NTIS HC A03/MF A01 CSCL 13H

Geometry plays a crucial role in nearly all design and production activities in the discrete goods industries. The deficiencies of current methods were retarding the progress of automation and were stimulating the development of new, computationally oriented schemes for handling mechanical geometry. The state of automation in the discrete goods industries, were surveyed, and then some key problems in defining and using 3-D geometric models were considered.
GRA

N79-10438# California State Dept. of Transportation, Sacramento. Transportation Lab.
THE EFFECTS OF COATINGS APPLIED TO CONTACT SURFACES OF HIGH STRENGTH BOLTED JOINTS ON SLIP BEHAVIOR AND STRENGTH OF JOINTS Final Report
J. P. Dusel, Jr., J. R. Stoker, and E. F. Nordlin Dec. 1977 66 p refs

(Contract DOT-D-4-112)
(PB-283154/3; FHWA/CA/TL-6610-77-34) Avail: NTIS HC A04/MF A01 CSCL 13E

The research objective was to determine if certain rust inhibiting coatings applied on contact surfaces of friction-type, high strength, bolted structural joints could provide sufficient slip resistance under constant or cyclic loads. The performance of various coatings, including a vinyl wash primer, an organic zinc-rich primer, and zinc metal applied by hot-dip galvanizing, were evaluated using results of tensile, creep, and cyclic tests on double shear butt spliced specimens. Important parameters in the testing program were coating type, hardness and thickness, clamping bolt tension, and method of loading. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N79-10439# Hartman (William F.), Knoxville, Tenn.
POTENTIAL APPLICATIONS OF ACOUSTIC EMISSION TECHNOLOGY AS A NONDESTRUCTIVE EVALUATION METHOD FOR NAVAL AVIATION GROUND SUPPORT Final Report, 13 Jul. 1977 - 16 Mar. 1978
William F. Hartman 5 Jul. 1978 21 p refs
(Contract N68335-77-M-5735)
(AD-A056650; NAEC-92-127) Avail: NTIS HC A02/MF A01 CSCL 01/5

This report presents the results of a survey of the potential use of acoustic emission monitoring for specific inspection and maintenance tasks in performance of ground support of Naval aircraft. One potential application, detecting corrosion in composites, is identified as worthy of an implementation study, since the U.S. Air Force has already proven feasibility. Feasibility studies are recommended for AE detection of defects in landing gear, cockpit canopies, fuel tanks, helicopter rotor blades, retreaded tires and fan blades. Research and development programs are suggested for bearing noise analysis, weld inspection, and damage assessment in composites. Author (GRA)

N79-10440# Army Tropic Test Center, APO New York 09827.
INTENSIVE TROPIC FUNCTION TESTING
Eldon M. Cady Jun. 1978 13 p
(AD-A056416) Avail: NTIS HC A02/MF A01 CSCL 15/5

Tropic testing of US Army materiel includes a storage phase designed to surface the adverse effects of the humid tropics. Failures are sometimes catastrophic, but are usually time dependent. Regulations such as AR 1000-1 require that efforts be made to reduce Development Test time. Project Managers and DARCOM commodity commands have curtailed or foregone Development Tests because of excessive time/cost considerations. It was hypothesized that reducing test calendar time while increasing test functioning time, i.e., increasing the ratio of operational hours to calendar days may yield quicker and still valid test results for some categories of equipment. Large quantities of Reliability, Availability and Maintainability (RAM) data could be generated quickly for immediate analysis using standard RAM data analysis. A methodology investigation was conducted at the US Army Tropic Test Center to validate the intensified testing concept and reassess storage testing. GRA

N79-10441# California Univ., Livermore. Lawrence Livermore Lab.
OPTICAL INSPECTION OF SMALL-DIAMETER DEEP BORES USING ROD OPTICS WITH LOW-LIGHT TELEVISION AND STILL PHOTOGRAPHY
D. E. Lord, R. R. Petrini, G. W. Carter, and T. D. Clark (Dupont de Nemours and Co., Aiken, South Carolina) 22 Feb. 1978 14 p refs
(Contract W-7405-eng-48)
(UCRL-52431) Avail: NTIS HC A02/MF A01

Modification of a commercially available rod optic system to allow internal corrosion inspection of a 2-in.-deep, 1/16-in-dia drill hole in stainless steel, and provide 90-deg (normal) views of the internal bore surface is described. To help detect corrosion and record its presence for more study, the rod optic was coupled to a low-light color video system and results were then compared to both color and black and white still photographs. The modified rod optic coupled to the low-light color video system is currently the best means of determining corrosion in small, deep bores. DOE

N79-10442# General Atomic Co., San Diego, Calif.
REVIEW OF METHODS FOR THE INTEGRATION OF RELIABILITY AND DESIGN ENGINEERING
J. T. Reilly Mar. 1978 127 p refs
(Contract EY-76-C-03-0167-023; Proj. 3228)
(GA-A-14748) Avail: NTIS HC A07/MF A01

A review of methods for the integration of reliability and design engineering was carried out to establish a reliability program philosophy, an initial set of methods, and procedures to be used by both the designer and reliability analyst. A set of procedures which implements a philosophy that requires increased involvement by the designer in reliability analysis was outlined. Discussions of each method reviewed include examples of its application. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N79-10443 Polytechnic Inst. of New York.
BUCKLING OF ORTHOGONALLY STIFFENED FINITE OVAL CYLINDRICAL SHELLS UNDER AXIAL COMPRESSION AND LATERAL PRESSURE Ph.D. Thesis
Vincent Italo Volpe 1978 122 p
Avail: Univ. Microfilms Order No. 7816650

The instability of an orthogonally stiffened cylindrical shell which is under axial compression and/or constant lateral pressure for various types of boundary conditions is investigated. The mathematical model begins with the establishment of a set of suitable large deflection shell equations. The stiffeners are treated as classical beam elements having axial, bending, and twisting stiffnesses. The formulation includes prebuckling deformations and ring-stiffener discreteness. The problem is solved by employing a modal expansion together with the total energy expression. Dissert. Abstr.

N79-10444 New Jersey Inst. of Technology, Newark.
DYNAMICS OF SUBMERGED CYLINDRICAL SHELLS WITH ECCENTRIC STIFFENING Ph.D. Thesis
Kerry Kier-Ten Chu 1978 80 p
Avail: Univ. Microfilms Order No. 7815892

A theoretical analysis is presented for treating the free vibrations of submerged. ring stiffened cylindrical shells with simply supported ends. The effects of the eccentric stiffeners are averaged over the thin-walled isotropic cylindrical shell. The energy method is utilized and the frequency equation is derived by Hamilton's Principle. All three degrees of freedom are considered. Numerical results are presented for frequencies and mode separation for several cases of interest. The cylindrical wave approximation and the plane wave approximation for the field equation were investigated. Their applicability was evaluated and the results indicate that only the cylindrical wave approximate method gives good agreement with the exact solution. For a steel shell in water with c = 5.82 slug/sec, the plane wave approximate method gives very poor results (about 5-20 percent accuracy). Dissert. Abstr.

N79-10445 Aeronautical Research Labs., Melbourne (Australia).
RESIDUAL STRENGTH OF A CRACKED LUG
R. J. Callinan Oct. 1977 37 p refs
(ARL-Struc-Note-442; AR-000-1101) Copyright. Avail: Issuing Activity

The finite element method and fracture mechanics concepts were used to calculate the residual strength of a pin-loaded lug

containing a through-the-thickness crack. The results are compared with some previously published experimental results for lugs containing quadrant cracks, although there are difficulties in establishing a proper basis for this comparison. A.R.H.

N79-10446*# Virginia Univ., Charlottesville. Dept. of Mechanical and Aerospace Engineering.
DYNAMIC ANALYSIS OF FLEXIBLE ROTOR-BEARING SYSTEMS USING A MODAL APPROACH Final Report, 1 Sep. 1976 - 31 Aug. 1977
K. C. Choy, E. J. Gunter, and L. E. Barrett Oct. 1978 371 p refs
(Grant NsG-3104)
(NASA-CR-157781; UVA/528144/MAE78/106) Avail: NTIS HC A16/MF A01 CSCL 20K

The generalized dynamic equations of motion were obtained by the direct stiffness method for multimass flexible rotor-bearing systems. The direct solution of the equations of motion is illustrated on a simple 3-mass system. For complex rotor-bearing systems, the direct solution of the equations becomes very difficult. The transformation of the equations of motion into modal coordinates can greatly simplify the computation for the solution. The use of undamped and damped system mode shapes in the transformation are discussed. A set of undamped critical speed modes is used to transform the equations of motion into a set of coupled modal equations of motion. A rapid procedure for computing stability, steady state unbalance response, and transient response of the rotor-bearing system is presented. Examples of the application of this modal approach are presented. The dynamics of the system is further investigated with frequency spectrum analysis of the transient response. Author

N79-10447*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
A STUDY OF MULTIPLE-SHAKER MODAL SURVEY TESTING Final Report, Feb. 1976 - Sep. 1978
William L. Hallauer, Jr. 1978 44 p refs
(Grant NsG-1276)
(NASA-CR-157890) Avail: NTIS HC A03/MF A01 CSCL 20K

The principal objective was to examine and to assess the practical value of a method of multiple-shaker sinusoidal modal vibration testing known as Asher's method. Numerical studies which simulate the application of Asher's method and a unique experimental implementation of the method were completed. Another objective of the research was to develop and to demonstrate with numerical simulation a quantitative method for determining from transfer function data the number of dominant modes of vibration in sinusoidal structural response. L.S.

N79-10448*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RESEARCH IN COMPUTERIZED STRUCTURAL ANALYSIS AND SYNTHESIS
Harvey G. McComb, Jr., comp. Oct. 1978 224 p refs Presented at a Symp. on Future Trends in Computerized Structural Analysis and Syn., Washington, D. C., 30 Oct. - 1 Nov. 1978; sponsored by George Washington Univ. and NSF and the Am. Soc. of Civil Engrs.
(NASA-CP-2059; L-12507) Avail: NTIS HC A10/MF A01 CSCL 20K

Computer applications in dynamic structural analysis and structural design modeling are discussed. For individual titles, see N79-10449 through N79-10465.

N79-10449*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE ATLAS INTEGRATED STRUCTURAL ANALYSIS AND DESIGN SOFTWARE SYSTEM
Rodney L. Dreisbach (Boeing-Com. Airplane Co.) and Gary L. Giles *In its* Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 1-14 refs (For primary document see N79-10448 01-39)
(Contracts NAS1-12911; DAAG46-75-C-0072)
Avail: NTIS HC A10/MF A01 CSCL 20K

The ATLAS system provides an extensive set of integrated technical computer-program modules for the analysis and design of general structural configurations, as well as capabilities that are particularly suited for the aeroelastic design of flight vehicles. The system is based on the stiffness formulation of the finite element structural analysis method and can be executed in batch and interactive computing environments on CDC 6600/CYBER computers. Problem-definition input data are written in an engineering-oriented language using a free field format. Input-data default values, generation options, and data quality checks provided by the preprocessors minimize the amount of data and flowtime for problem definition/verfication. Postprocessors allow selected input and calculated data to be extracted, manipulated, and displayed via on-line and off-line prints or plots for monitoring and verifying problem solutions. The sequence and mode of execution of selected program modules are controlled by a common user-oriented language. G.G.

N79-10450*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NUMERICAL AERODYNAMIC SIMULATION FACILITY
F. R. Bailey and A. W. Hathaway *In* NASA. Langley Res. Center Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 15-30 refs (For primary document see N79-10448 01-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

Critical to the advancement of computational aerodynamics capability is the ability to simulate flows about three-dimensional configurations that contain both compressible and viscous effects, including turbulence and flow separation at high Reynolds numbers. Analyses were conducted of two solution techniques for solving the Reynolds averaged Navier-Stokes equations describing the mean motion of a turbulent flow with certain terms involving the transport of turbulent momentum and energy modeled by auxiliary equations. The first solution technique is an implicit approximate factorization finite-difference scheme applied to three-dimensional flows that avoids the restrictive stability conditions when small grid spacing is used. The approximate factorization reduces the solution process to a sequence of three one-dimensional problems with easily inverted matrices. The second technique is a hybrid explicit/implicit finite-difference scheme which is also factored and applied to three-dimensional flows. Both methods are applicable to problems with highly distorted grids and a variety of boundary conditions and turbulence models. G.G.

N79-10451*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE CURRENT STATUS OF MICROCOMPUTER ARRAYS
John C. Knight and Robert G. Voigt (Inst. for Computer Appl. in Sci. and Eng.) *In its* Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 31-42 refs (For primary document see N79-10448 01-39)
(Contract NAS1-14101)
Avail: NTIS HC A10/MF A01 CSCL 09B

Some research projects on microcomputer arrays are at the stage of constructing hardware, while others are at the design and planning stages. A general overview of the topic is followed by a more detailed discussion of three projects whose purposes are specifically scientific computation. G.G.

N79-10452*# Washington Univ., Seattle.
ADAPTIVE FINITE ELEMENT ANALYSIS BASED ON P-CONVERGENCE
B. A. Szabo, P. K. Basu, and M. P. Rossow *In* NASA. Langley Res. Center Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 43-50 refs (For primary document see N79-10448 01-39)
Avail: NTIS HC A10/MF A01 CSCL 12A

The results of numerical experiments are presented in which a posteriori estimators of error in strain energy were examined on the basis of a typical problem in linear elastic fracture mechanics. Two estimators were found to give close upper and lower bounds for the strain energy error. The potential significance of this is that the same estimators may provide a suitable basis for adaptive redistribution of the degrees of freedom in finite element models. Author

N79-10453*# Sikorsky Aircraft, Stratford, Conn.
FINITE ELEMENT ANALYSIS OF HELICOPTER STRUCTURES

Melvin J. Rich *In* NASA. Langley Res. Center Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 51-61 refs (For primary document see N79-10448 01-39)
Avail: NTIS HC A10/MF A01 CSCL 01C

Application of the finite element analysis is now being expanded to three dimensional analysis of mechanical components. Examples are presented for airframe, mechanical components, and composite structure calculations. Data are detailed on the increase of model size, computer usage, and the effect on reducing stress analysis costs. Future applications for use of finite element analysis for helicopter structures are projected. G.G.

N79-10454*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SYNTHESIS OF AIRCRAFT STRUCTURES USING INTEGRATED DESIGN AND ANALYSIS METHODS Status Report
Jaroslaw Sobieszczanski-Sobieski and Robert C. Goetz *In its* Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 63-76 refs (For primary document see N79-10448 01-39)
Avail: NTIS HC A10/MF A01 CSCL 01C

A systematic research is reported to develop and validate methods for structural sizing of an airframe designed with the use of composite materials and active controls. This research program includes procedures for computing aeroelastic loads, static and dynamic aeroelasticity, analysis and synthesis of active controls, and optimization techniques. Development of the methods is concerned with the most effective ways of integrating and sequencing the procedures in order to generate structural sizing and the associated active control system, which is optimal with respect to a given merit function constrained by strength and aeroelasticity requirements. G.G.

N79-10455*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FINITE ELEMENT ANALYSIS IN A MINICOMPUTER/MAINFRAME ENVIRONMENT
Olaf O. Storaasli and Ronald C. Murphy (George Washington Univ, Washington, D. C.) *In its* Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 77-88 refs (For primary document see N79-10448 01-39)
Avail: NTIS HC A10/MF A01 CSCL 09B

Design considerations were evaluated for general purpose finite element systems to maximize performance when installed on distributed computer hardware/software systems. It is shown how the features of current minicomputers complement those of a modular implementation of the finite of the finite element method for increasing the control, speed, and visibility (interactive graphics) in solving a broad range of structural problems at reduced cost. The approach used is to implement a finite element system in a distributed computer environment to solve structural problems and to explore alternatives in distributing finite element computations. G.G.

N79-10456*# Queens Univ., Kingston (Ontario).
FINITE ELEMENT MESH CONFIGURATIONS USING ISOENERGETICS AND EQUALIZED ENERGY LEVELS
David J. Turcke *In* NASA. Langley Res. Center Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 89-99 refs (For primary document see N79-10448 01-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

The concept of equalizing energy levels was shown to be a viable additional criterion in laying out finite element grids according to the isoenergetic discretization technique. Similar problems specifically with respect to mesh refinement in piecewice approximation theory are being researched. Common criteria in both areas are developed in an effort to cope with the question of discretization for improved piecewise approximations. G.G.

N79-10457*# Cape Town Univ. (South Africa).
DYNAMIC PROGRAMMING AND DIRECT INTERACTION FOR THE OPTIMUM DESIGN OF SKELETAL TOWERS
G. C. Howell and W. S. Doyle *In* NASA. Langley Res. Center Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 101-118 (For primary document see N79-10448 01-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

A computer technique is proposed for automatically designing tower structures. Dynamic programming was used to find the optimum geometric configuration of the structural members, while the member sizes were proportioned by direct iteration. Tower structures are particularly suited to this method of automatic design since the rapidity of the analysis and design depends primarily upon substructuring. Substructuring of towers was comparatively simple because interaction between adjacent substructures is simulated with reasonable accuracy. Typical examples are presented to illustrate the method. G.G.

N79-10458*# Grumman Aerospace Corp., Bethpage, N.Y.
ADAPTATION OF A PROGRAM FOR NONLINEAR FINITE ELEMENT ANALYSIS TO THE CDC STAR 100 COMPUTER
Allan B. Pifko (Grumman Data Systems Corp.) and Patricia L. Ogilvie *In* NASA. Langley Res. Center Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 119-139 refs (For primary document see N79-10448 01-39)
(Contract NAS1-13148)
Avail: NTIS HC A10/MF A01 CSCL 09B

The conversion of a nonlinear finite element program to the CDC STAR 100 pipeline computer is discussed. The program called DYCAST was developed for the crash simulation of structures. Initial results with the STAR 100 computer indicated that significant gains in computation time are possible for operations on gloval arrays. However, for element level computations that do not lend themselves easily to long vector processing, the STAR 100 was slower than comparable scalar computers. On this basis it is concluded that in order for pipeline computers to impact the economic feasibility of large nonlinear analyses it is absolutely essential that algorithms be devised to improve the efficiency of element level computations. G.G.

N79-10459*# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
ON A NEW ALGORITHM FOR TIME STEP INTEGRATION OF NONLINEAR SYSTEMS
Edoardo Anderheggen and Gianni Bazzi *In* NASA. Langley Res. Center Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 141-151 refs (For primary document see N79-10448 01-39)
Avail: NTIS HC A10/MF A01 CSCL 12A

A new implicit algorithm for time step integration of finite element structural dynamic equations is presented. Convergence, stability and numerical damping properties are discussed. Due to the way nonlinear structural behavior is taken into account, the algorithm is expected to compare favorably with existing ones. Some simple numerical results are presented. A related explicit algorithm is also derived and shortly discussed. Author

N79-10460*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THREE-DIMENSIONAL FINITE STRIP ANALYSIS OF ELASTIC SOLIDS
M. S. Cheung (Public Works Canada) and M. Y. T. Chan (Public Works Canada) *In its* Res in Computerized Structural Analysis and Syn., Oct. 1978 p 153-164 refs (For primary document see N79-10448 01-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

Finite element shape functions were combined with beam eigenfunctions to formulate three-dimensional finite strips. Because of the orthogonality of the beam functions, three-dimensional problems were reduced to a series of two-dimensional problems, often with stiffness matrices of very narrow bandwidth. Isoparametric and high order finite element shape functions were used in the formulation of the 3-D finite strips. Numerical examples such as the static and free vibration analyses of simply supported thick plates are presented. Results were compared with existing solutions and good agreements were obtained in all cases. G.G.

N79-10461*# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE INCORPORATION OF TRUNCATED FOURIER SERIES INTO INFINITE DIFFERENCE APPROXIMATIONS OF STRUCTURAL STABILITY EQUATIONS
Steven R. Hannah and Anthony N. Palazotto *In* NASA. Langley Res. Center Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 165-174 refs (For primary document see N79-10448 01-39)
Avail: NTIS HC A10/MF A01 CSCL 12A

A new trigonometric approach to the finite difference calculus was applied to the problem of beam buckling as represented by virtual work and equilibrium equations. The trigonometric functions were varied by adjusting a wavelength parameter in the approximating Fourier series. Values of the critical force obtained from the modified approach for beams with a variety of boundary conditions were compared to results using the conventional finite difference method. The trigonometric approach produced significantly more accurate approximations for the critical force than the conventional approach for a relatively wide range in values of the wavelength parameter; and the optimizing value of the wavelength parameter corresponded to the half-wavelength of the buckled mode shape. It was found from a modal analysis that the most accurate solutions are obtained when the approximating function closely represants the actual displacement function and matches the actual boundary conditions. G.G.

N79-10462*# MARC Analysis Research Corp., Palo Alto, Calif.
STRUCTURAL ANALYSIS CONSULTATION USING ARTIFICIAL INTELLIGENCE
R. J. Melosh, P. V. Marcal, and Les Berke (Flight Dynamics Lab., Wright-Patterson AFB, Ohio) *In* NASA. Langley Res. Center Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 175-194 refs (For primary document see N79-10448 01-39)
Avail: NTIS HC A10/MF A01 CSCL 20K

The primary goal of consultation is definition of the best strategy to deal with a structural engineering analysis objective. The knowledge base to meet the need is designed to identify the type of numerical analysis, the needed modeling detail, and specific analysis data required. Decisions are constructed on the basis of the data in the knowledge base - material behavior, relations between geometry and structural behavior, measures of the importance of time and temperature changes - and user supplied specifics characteristics of the spectrum of analysis types, the relation between accuracy and model detail on the structure, its mechanical loadings, and its temperature states. Existing software demonstrated the feasibility of the approach, encompassing the 36 analysis classes spanning nonlinear, temperature affected, incremental analyses which track the behavior of structural systems. G.G.

N79-10463*# Tennessee Univ., Knoxville.
A DIRECT ELEMENT RESEQUENCING PROCEDURE
J. E. Akin and R. E. Fulford *In* NASA. Langley Res. Center Res. in Computerized Structural Analysis and Syn. Oct. 1978 p 195-203 refs (For primary document see N79-10448 01-39)
Avail: NTIS HC A10/MF A01 CSCL 09B

Element by element frontal solution algorithms are utilized in many of the existing finite element codes. The overall computational efficiency of this type of procedure is directly related to the element data input sequence. Thus, it is important to have a pre-processor which will resequence these data so as to reduce the element wavefronts to be encountered in the solution algorithm. A direct element resequencing algorithm is detailed for reducing element wavefronts. It also generates computational by products that can be utilized in pre-front calculations and in various post-processors. Sample problems are presented and compared with other algorithms. G.G.

N79-10464*# George Washington Univ., Washington, D. C.
PROGRESSIVE FAILURE OF STRUCTURES
Khalilollah Khozeimeh, G. Theodore G. Toridis, and Shahram E. Zanganeh (Howard Univ., Wash. D.C.) *In* NASA. Langley Res. Center Res. in. Computerized Structural Analysis and Syn., Oct. 1978 p 205-219 refs (For primary document see N79-10448 01-39)
(Grant NSF ENG-76-00332)
HC A10/MF A01 CSCL 20K

A procedure is presented for determining the nonlinear behavior of structures subjected to extreme loading and the possibility of development of potential for progressive failure. The methodology takes into account the effect of both material and geometric nonlinearities. At a given stage of analysis, the individual components of the structure are checked against predetermined failure criteria. Subsequently, the failing components are removed and the modified structure is analyzed for overall failure. Examples, obtained from a computer program based on the proposed procedure, showing the applicability of the method are presented. Author

N79-10465*# California Univ., Berkeley.
THE LANCZOS ALGORITHM WITH SELECTIVE ORTHOGONALIZATION
B. N. Parlett and D. S. Scott (Union Carbide) *In* NASA. Langley Res. Center Res. in Computerized Structural Analysis and Syn., Oct. 1978 p 221-224 refs (For primary document see N79-10448 01-39)
(Contract N00014-76-C-0013)
Avail: NTIS HC A10/MF A01 CSCL 20F

A new stable and efficient implementation of the Lanczos algorithm is presented. The algorithm is a powerful method for finding a few eigenvalues and eigenvectors at one or both ends of the spectrum of a symmetric matrix A. The algorithm is particularly effective if A is large and sparse in that the only way in which A enters the calculation is through a subroutine which computes Av for any vector v. Thus the user is free to take advantage of any sparsity structure in A and A need not even be represented as a matrix et al. G.G.

N79-10466# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
THE STATISTICAL NATURE OF FATIGUE CRACK PROPAGATION Final Report, Jun. 1976 - May 1978
D. A. Virkler, B. M. Hillberry, and P. K. Goel Mar. 1977 232 p refs
(Grant AF-AFOSR-3018-76)
(AD-A056912; AFFDL-TR-43-78) Avail: NTIS HC A11/MF A01 CSCL 11/6

A statistical investigation of the fatigue crack propagation process was conducted. Sixty-eight replicate constant amplitude crack propagation tests were conducted on 2024- T3 aluminum alloy. The following distributions were considered two-parameter normal distribution, three-parameter log-normal distribution, three-parameter Weibull distribution, two-parameter gamma distribution, three-parameter gamma distribution, the generalized three-parameter gamma distribution, and the generalized four-parameter gamma distribution. From the experimental data, the distribution of N as a function of crack length was best represented by the three-parameter log-normal distribution. Six growth rate calculation methods were investigated and the method which introduced the least amount of error into the growth rate data was found to be a modified secant method. Based on the distribution of da/d N, which varied moderately as a function of crack length, replicate a vs. N data were predicted. This predicted data reproduced the mean behavior but not the variant behavior of the actual a vs. N data. GRA

N79-10467# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
CRACK GROWTH BY CONCENTRATED PLASTIC FLOW Final Report, 1 May 1972 - 31 Oct. 1975
Frank A. McClintock 28 Jun. 1978 29 p refs
(Contract DAHC04-72-C-0043)
(AD-A056723; ARO-10152.1-E) Avail: NTIS HC A03/MF A01 CSCL 20/11

A criterion that test specimens be large enough for valid fracture prediction from J sub Ic tests appears to be that the stress at the half-ligament dimension, calculated from J sub Ic and the Hutchinson-Rice-Rosengren singularity, be no more than 1.05 to 1.1 times the yield strength. For smaller specimens, the J-integral varied linearly with ligament size and was surprisingly similar for single and double grooved specimens. On the other hand, fully plastic triaxiality was shown to be very important in welded plates of A-36 steel, in which the transition temperature for brittle crack propagation was raised 40 K above the Charpy value by the triaxiality due to simulated cracks on both sides of the plate. This may also be of interest in fragmentation. GRA

N79-10468# Army Construction Engineering Research Lab., Champaign, Ill.
EQUIVALENT VISCOUS DAMPING OF ELASTO-PLASTIC SYSTEMS UNDER SINUSOIDAL LOADING
R. G. Merritt Jul. 1978 28 p
(DA Proj. 4A7-62731-AT-41)
(AD-A057225; CERL-SR-M-242) Avail: NTIS

HC A03/MF A01 CSCL 20/11

This report addresses the possibility of establishing a simple algorithm applicable to structural design that would provide information on a nonlinear structural system based on information on a linear damped structural system. Two variables were considered -- geometrical stiffness and resonant amplitude. Although the geometrical stiffness approach was determined more adequate in accounting for the frequency shift in a nonlinear system, the maximum displacement values it displayed throughout the frequency range were unconservative. The resonant amplitude approach indicated more conservative values in an intermediate range of frequencies, but its lower range values, where nonlinear systems demonstrate resonance, were also unconservative. This report determines that the application of a weighted average of linear viscous damped system displacement to define nonlinear system displacement does not provide a satisfactory method of equivalencing systems by either the resonant amplitude or geometrical stiffness approach. Author (GRA)

N79-10469# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

THE BUCKLING PRESSURE OF AN ELASTIC PLATE FLOATING ON WATER AND STRESSED UNIFORMLY ALONG THE PERIPHERY OF AN INTERNAL HOLE

Shunsuke Takagi Jun. 1978 57 p refs

(DA Proj. 4A1-61102-AT-24)

(AD-A056585; CRREL-78-14) Avail: NTIS HC A04/MF A01 CSCL 20/10

The analytical solution and the numerical study of the eigenvalue problem for determining the buckling pressure of an infinite elastic plate floating on water and stressed uniformly along the periphery of an internal hole is presented. The boundary conditions considered are the clamped-, simple-, and free-edge conditions. Small buckling pressure occurs only for the free-edge condition. The shape of the deflection for the free-edge condition suggests that buckling is an important mechanism of failure. Author (GRA)

N79-10470# Los Alamos Scientific Lab., N. Mex.

BREAKUP OF AN ACCELERATED SHELL OWING TO RAYLEIGH-TAYLOR INSTABILITY

B. R. Suydam Jun. 1978 15 p refs

(Contract W-7405-eng-36)

(LA-7291-MS) Avail: NTIS HC A02/MF A01

A simplified model for the Rayleigh-Taylor instability of an accelerated shell is examined, and it is found that the most dangerous wavelength to be about that of the shell thickness. The shell material is assumed to be an inviscid, incompressible fluid. Effects of finite compressibility and of surface tension are found to be negligible, but the effects of viscosity are shown to be very large. The need for better knowledge of viscosity at high pressure is pointed out. DOE

N79-10471# Battelle Columbus Labs., Ohio.

END EFFECTS ON ELBOWS SUBJECTED TO MOMENT LOADINGS

E. C. Rodabaugh, S. K. Iskander, and S. E. Moore Mar. 1978 73 p refs

(Contract W-7405-eng-26)

(ORNL/Sub-2913/7) Avail: NTIS HC A04/MF A01

End effects on elbows subjected to moment loading are investigated using the finite element program EPACA. Relatively simple but more accurate equations are developed and recommendation for a method using these equations is presented. Data from EPACA on stresses at welds (elbow-to-pipe juncture) are presented. A simple equation is given for estimating the maximum stresses at the welds. DOE

N79-10472# Oak Ridge National Lab., Tenn.

APPLICATION OF ANISOTROPIC ELASTICITY TO CENTRIFUGALLY CAST PIPING

B. R. Dewey, L. Adler, R. T. King, and K. V. Cook Oct. 1977 19 p refs

(Contract W-7405-eng-26)

(ORNL/TM-5994) Avail: NTIS HC A02/MF A01

The matrices of anisotropic elastic constants, using both ultrasonic and conventional techniques were determined for pipes of the CPF8 and CPF8M grades. The strong anisotropy, which arises from the directional solidification inherent in the centrifugal casting process, can adequately be represented by orthotropic symmetry. To demonstrate the importance of considering the anisotropy, the resulting mechanical properties are used in examples of stress analyses for pipes subject to pressure. DOE

N79-10473# Oak Ridge National Lab., Tenn. Engineering Technology Div.

STRESS ANALYSIS OF CYLINDRICAL PRESSURE VESSELS WITH CLOSELY SPACED NOZZLES BY THE FINITE-ELEMENT METHOD. VOLUME 1: STRESS ANALYSIS OF VESSELS WITH TWO CLOSELY SPACED NOZZLES UNDER INTERNAL PRESSURE

F. K. W. Tso (System Develop. Corp.), J. W. Bryson (System Develop. Corp.), R. A. Weed, and S. E. Moore 4 Oct. 1977 121 p refs

(Contract W-7405-eng-26)

(ORNL/NUREG-18/V1) Avail: NTIS HC A06/MF A01

A finite element computer program, MULT-NOZZLE, was developed for the stress analysis of cylindrical pressure vessels with two or three closely spaced reinforced nozzles. MULT-NOZZLE consists of two modules which may be operated independently. The first module, GEMG, automatically prepares a finite element mesh including the nodal point coordinates, finite element connectivities, mesh options, and boundary value specifications for input to the finite element solution module SAP3M. SAP3M, which is a modified and improved version of the SAP3 computer program, computes the nodal point displacements and stress tensor components, and prints and/or stores the results for later postprocessing. The accuracy of the SAP3M module was demonstrated by comparison studies of two classical theory of elasticity problems: a simply suppported beam and a thick-walled ring under internal pressure loading. A complete discussion of MULT-NOZZLE is presented in four volumes. DOE

N79-10474# New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.

ESTIMATING LATERAL FLANGE BENDING IN CURVED PLATE GIRDERS Interim Report

Robert J. Kissane Apr. 1978 38 p refs Sponsored in part by DoT

(PB-281950/6; RR-78-60; FHWA/NY-78/RR/60; IR-6) Avail: NTIS HC A03/MF A01 CSCL 13B

Experimental and analytical data from two small-scale models are used to develop an approximate procedure for estimating lateral flange bending moments in uniformly loaded simple-span, horizontally curved plate girders. The results show that the maximum lateral flange bending moment can be conservatively estimated as 1/12 of the lateral component of the flange force due to normal bending, multiplied by the diaphragm spacing squared. GRA

N79-10475# California Univ., Berkeley. Div. of Structural Engineering and Structural Mechanics.

A SIMPLE AND EFFICIENT FINITE ELEMENT FOR GENERAL SHELL ANALYSIS

Worsak Kanok-Nukulchai Jan. 1978 48 p refs

(Contract DOT-HS-6-01443)

(PB-281177/6; UCSESM-78-1) Avail: NTIS HC A03/MF A01 CSCL 13B

A simple, efficient and versatile finite element is introduced for shell applications. The element is developed based on a degeneration concept, in which the displacements and rotations of the shell mid-surface are independent variables. Bilinear functions are employed in conjunction with a reduced integration for the transverse shear energy. Several examples are tested to demonstrate the effectiveness and versatility of the element. The numerical results indicate that the shell element performs accurately for both thick and thin shell situations. GRA

N79-10476# Battelle Columbus Labs., Ohio.

CRITICAL EXPERIMENTS, MEASUREMENTS AND ANALYSES TO ESTABLISH A CRACK ARREST METHODOLOGY FOR NUCLEAR PRESSURE VESSEL STEELS Annual Progress Report, Oct. 1976 - Sep. 1977

H. T. Corten, K. S. Kim, C. P. Debel, C. W. Marschall, P. C. Cohlen, C. Popelar, R. G. Hoagland, A. R. Rosenfield, M. F.

Kanninen, G. T. Hahn et al May 1978 231 p refs
(Contract AT(49-24)-0293)
(PB-282689/9; BMI-1995; NUREG-CR-0057; APR-3) Avail: NTIS HC A11/MF A01 CSCL 18J

Dynamic, two dimensional finite difference analyses of run-arrest events in single edge notch and compact tension specimens were carried out and refined. The governing equations were derived for a dynamic, two dimensional analyses of a long axial crack propagating radially in the wall of a cylinder under thermal shock. A preliminary trial of the analysis was conducted for the conditions of the Oak Ridge National Laboratory Thermal Shock Experiments. A rest method of measuring the crack arrest toughness values of practical interest was developed, refined, verified, and submitted for standardization. GRA

N79-10477# Advisory Group for Aerospace Research and Development, Paris (France).

CHARACTERIZATION OF LOW CYCLE HIGH TEMPERATURE FATIGUE BY THE STRAINRANGE PARTITIONING METHOD

Aug. 1978 350 p refs In ENGLISH and FRENCH Presented at the 46th Meeting of the AGARD Struct. and Mater. Panel, Aalborg, Denmark, 11-12 Apr. 1978
(AGARD-CP-243; ISBN-92-835-0220-5) Copyright. Avail: NTIS HC A15/MF A01

A number of laboratories in several countries participated, each testing its own materials of interest under its own laboratory conditions to ensure that the results obtained would provide validation for a wide range of aerospace materials and to ensure maximum usefulness to each participating laboratory of the strainrange partitioning method. For individual titles, see N79-10478 through N79-10494.

N79-10478*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Mechanical and Aerospace Engineering.

THE DEVELOPMENT AND APPLICATION OF STRAINRANGE PARTITIONING AS A TOOL IN THE TREATMENT OF HIGH TEMPERATURE METAL FATIGUE

S. S. Manson *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 11 p refs (For primary document see N79-10477 01-39)
(Grant NsG-7035)
Avail: NTIS HC A15/MF A01 CSCL 20K

The effects of frequency, stress and strain hold periods, stress and strain ramping, creep-fatigue interspersion, and thermomechanical cycling were studied. Of special interest was the establishment of a set of universalized life relations which were normalized by the ductility of the material. These relations together with a set of rules that were devised for treating multiaxiality by the method, were, for example, useful in predicting torsion behavior, and in particular in establishing a new relationship between torsion and tension that had previously not been considered. They also were useful in the development of a framework for treatment of environmental effects. J.A.M.

N79-10479*# TRW, Inc., Cleveland, Ohio. Materials Technology Lab.

A STRAINRANGE PARTITIONING ANALYSIS OF LOW CYCLE FATIGUE OF COATED AND UNCOATED RENE 80

C. S. Kortovich and A. A. Sheinker *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 23 p refs Sponsored in part by Army Air Mobility Res. and Develop. Lab. (For primary document see N79-10477 01-39)
(Contract NAS3-17830)
Avail: NTIS HC A15/MF A01 CSCL 20K

A strainrange partitioning analysis was conducted on ultrahigh vacuum, strain-controlled, low-cycle fatigue behavior of uncoated and aluminide coated Rene' 80 nickel-base superalloy at 1000 C (1832 F) and 871 C (1600 F). The results indicated little effect of coating or temperature on the fatigue resistance. There was, however, a significant effect on fatigue life when creep was introduced into the strain cycles. The effect of this creep component was analyzed in terms of the method of strainrange partitioning. Author

N79-10480*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

STRAINRANGE PARTITIONING BEHAVIOR OF THE NICKEL-BASE SUPERALLOYS, RENE 80 AND IN-100

G. R. Halford and A. J. Nachtigall *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 14 p refs (For primary document see N79-10477 01-39)
Avail: NTIS HC A15/MF A01 CSCL 20K

A study was made to assess the ability of the method of strainrange partitioning (SRP) to both correlate and predict high temperature, low cycle fatigue lives of nickel-base superalloys for gas turbine applications. Baseline data from strain-controlled, low cycle fatigue tests were expressed in terms of the PP, PC, CP, and CC partitioned inelastic strainrange versus life relationships for coated and uncoated Rene' 80 at 1000 C, Gatorized (creep-formed)IN 100 at 760 C, and cast IN 100 at 925 C. The SRP is shown to correlate the cyclic lives of the baseline tests to within factors of nearly two. The partitioned strainrange versus life relationships for uncoated Rene' 80 and cast IN 100 were also determined from the ductility normalized-strainrange partitioning equations. These were used to predict the cyclic lives of the baseline tests. Predicted and observed cyclic lives agreed to within factors of nearly three. J.A.M.

N79-10481# Pratt and Whitney Aircraft, West Palm Beach, Fla. Mechanics of Materials and Structures Div.

LOW CYCLE FATIGUE BEHAVIOR OF IN-100: STRAINRANGE PARTITIONING METHOD

M. C. VanWanderham, R. M. Wallace, and C. G. Annis, Jr. *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 17 p refs (For primary document see N79-10477 01-39)
Avail: NTIS HC A15/MF A01

The elevated temperature, low cycle fatigue of the gas turbine disk alloy IN-100 was evaluated, using the strainrange partitioning method. Strainrange partitioning, an advanced life prediction analysis procedure, assumed that any hysteresis loop could be represented by combinations of the four generic cycle definitions: PP, CP, PC, and CC. The first letter refers to the material response in tension, either plastic (time independent) or creep (time dependent), and the second letter refers to material response in compression. J.A.M.

N79-10482# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

APPLICABILITY OF THE SRP METHOD AND CREEP-FATIGUE DAMAGE APPROACH TO THE LCHTF LIFE PREDICTION OF IN-100 ALLOY

J. L. Chaboche, H. Policella, and H. Kaczmarek *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 20 p refs (For primary document see N79-10477 01-39)
Avail: NTIS HC A15/MF A01

The main objective was to compare the actual capabilities of two life prediction methods in the low cycle high temperature regime. (1) The simplest one was the strain range partitioning which needed a number of special tests, involving creep and fatigue interaction, but it was difficult to apply under complex situations where the inelastic strain components were small or when strain and temperature varied simultaneously. (2) The second one was the continuous damage approach, which could be applied to the prediction of the creep-fatigue interaction phenomenon, by means of pure fatigue tests, pure creep tests, and corresponding damage equations. The two methods were evaluated for the IN-100 alloy at 900 and 1000 C. J.A.M.

N79-10483# Cranfield Inst. of Technology Bedfordshire (England). Dept. of Materials.

STRAINRANGE PARTITIONING OF MAR MOO2 OVER THE TEMPERATURE RANGE 750 DEG C - 1040 DEG C

V. T. A. Antunes and P. Hancock *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 9 p refs Sponsored in cooperation with the Min. of Nacl. de Invest. Cient. e Tecnol. (For primary document see N79-10477 01-39)
Copyright. Avail: NTIS HC A15/MF A01

The fatigue behavior of a cast nickel base, superalloy Mar MOO2 was studied in the temperature range 750 - 1040 C by the method of strainrange partitioning, (SrP). The four basic

strainrange vs life relationships Nij - delta epsilon ij (i = P or C; j = P or C) were determined at 850 and 1040 C. A marked temperature sensitivity was observed, and it was not possible to predict 1040 deg lives from 850 data. Satisfactory life prediction could be made by the SrP method over limited temperature ranges. Prediction within the range 750 to 850 C, or within the range 950 - 1040 C proved to be satisfactory, employing a unique set of Nij - delta epsilon ij strainrange vs life relationships for each temperature range. J.A.M.

N79-10484# National Gas Turbine Establishment, Farnborough (England). Materials Science Dept.

THE LOW CYCLE FATIGUE BEHAVIOR OF NIMONIC 90 AT ELEVATED TEMPERATURE

G. F. Harris and M. J. Weaver *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 19 p refs (For primary document see N79-10477 01-39)

Avail: NTIS HC A15/MF A01

High temperature strain controlled fatigue data for the wrought nickel base alloy, Nimonic 90 are presented, together with their interpretation based on the concept of strain range partitioning. When this approach was used to predict data at 650 and 900 C, using those generated at 810 C, the lives at 650 C were accurate to within a factor of two whereas at 900 C, actual test results were much less than the predicted values. The difficulty encountered when using the partitioning approach to predict low frequency test results, is discussed. The data were examined in terms of stress, as opposed to strain and predictions, using a stress/static-creep data approach. J.A.M.

N79-10485# Rolls-Royce Ltd., Derby (England). Material Services Lab.

AN APPLICATION OF STRAINRANGE PARTITIONING TO THE LOW CYCLE - HIGH TEMPERATURE FATIGUE LIFE PREDICTION OF WASPALOY

G. Asquith and S. H. Sprinthall *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 13 p refs (For primary document see N79-10477 01-39)

Avail: NTIS HC A15/MF A01

From a lin ited series of fully reversed strain controlled low cycle fatigue and cyclic creep testing at 700 C, the basic partitioned life relationships were established. It was shown that from these basic relationships reasonable life to failure prediction was possible for more complex combined creep-fatigue interactions. It was observed from the experimental test data that there were marked differences in the mean stress levels generated for each strain range component and level of inelastic strain range. J.A.M.

N79-10486# Laboratorio per la Tecnologia dei Materiali Metallici non Tradizionali, Milan (Italy).

HIGH TEMPERATURE LOW CYCLE FATIGUE BEHAVIOR OF CAST IN738LC ALLOY

L. Massarelli *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 5 p refs (For primary document see N79-10477 01-39)

Avail: NTIS HC A15/MF A01

The high temperature low cycle fatigue behavior of a nickel base alloy in the cast condition was investigated by carrying out tests under diametral strain controlled conditions. The effect of anisotropy at diametral strain, which was especially marked in the cast alloys owing to the large grain size, was offset by mounting the diametral extensometer at a position along the minimum diameter section of the specimen where Poisson's ratio assumed its mean value. Cyclic and fatigue tests under conditions of constant amplitude diametral strain and at two different strain rates were carried out on IN738LC alloy at the temperature of 850 C. The results confirmed the repeatability of the tests carried out. J.A.M.

N79-10487# Centre d'Essai Aeronautique, Toulouse (France). Ingenieur des Etudes et Techniques d'Armement.

EVALUATION OF THE STRAINRANGE PARTITIONING APPLIED TO A NICKEL BASE WASPALOY [CONTRIBUTION A L'EVALUATION DE LA METHODE STRAIN RANGE PARTITIONINS APPLICATION A L'ALLIAGE BASE NICKEL WASPALOY]

C. Perruchet *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 19 p refs In FRENCH, ENGLISH summary (For primary document see N79-10477 01-39)

Avail: NTIS HC A15/MF A01

A Waspaloy's basic properties study was completed, including chemical analysis, macrographic and micrographic investigations, linear thermal expansion coefficient measurement, monotonic tensile properties determination at room and elevated temperature (up to 900 c), and cyclic stress-strain properties evaluation. Establishment of the four basic life relationships of SRP was completed at 750 C the SRP method was applied to a complex strain cycle for two values of total diametral strain corresponding to very low cycle fatigue lives (a few hundreds of cycles). In this field, SRP method validity has appeared as excellent, since average difference between predicted and tested values of fatigue life was about 12.5 percent. J.A.M.

N79-10488 National Physical Lab., Teddington (England). Div. of Materials Applications.

CREEP FATIGUE INTERACTION IN ALLOY IN738LC

M. F. Day and G. B. Thomas *In* AGARD Characterization of Low Cycle High Temp. Faitgue by the Strainrange Partitioning Method Aug. 1978 13 p refs (For primary document see N79-10477 01-39)

Avail: NTIS HC A15/MF A01

Low cycle fatigue test results on a cast Ni-Cr-base alloy IN738LC have shown that cycles containing tensile dwell periods have extended cyclic endurances. The results compared on total inelastic strain (hysteresis strain loop width) fall into two groups, HRSC and CCCR cycles, and BCCR and TCCR cycles. Strain range partitioning could not be successfully applied in its present form to the data produced. Analysis of the data by the method proposed by Ostergren gave cyclic endurance predictions generally within a factor of plus 2 for all the types of test cycles employed at 750 and 850 C. Use of a simple fractional life approach using the pp and pc components to assess the fatigue contribution, and summed dwell times in tension to assess the creep contribution, has given predictions of similar accuracy. Microstructural examination revealed typical fatigue failures in specimens tested with HRSC and CCCR cycles. In specimens tested with BCCR and TCCR cycles there was a tendency to intergranular creep damage which predominated at the higher strain ranges in TCCR tests. J.A.M.

N79-10489# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

AN ANALYSIS OF THE LOW CYCLE FATIGUE BEHAVIOR OF THE SUPERALLOY RENE 95 BY STRAINRANGE PARTITIONING

Jack M. Hyzak and Bernstein (Systems Res. Labs., Dayton, Ohio) *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 25 p refs (For primary document see N79-10477 01-39)

(Contracts F33625-76-C-5245; F33615-76-C-5191)

Avail: NTIS HC A15/MF A01

The applicability of strainrange partitioning (SRP) for predicting the low cycle fatigue (LCF) behavior of the superalloy Rene 95 at 922K (1200) was addressed. A three phase test plan in described which consists of baseline strain control testing, cyclic creep tests utilizing load control to strain limits, and validation testing comprised of less conventional waveforms. The data indicated that compressive strain hold cycles were more damaging than tensile strain hold cycles. It was also shown that the LCF behavior of this alloy depends largely on the time in tension per cycle and on the value of the maximum tensile stress which develops large biases during strain hold tests that generated the largest changes in the value of the maximum tensile stress compared to time independent behavior. T.A.M.

N79-10490# Mar-Test, Inc., Cincinnati, Ohio.

AN APPLICATION OF STRAINRANGE PARTITIONING TO COPPER-BASE ALLOYS AT 538 DEG C

R. H. Stentz, J. T. Berling, and J. B. Conway *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 20 p refs (For primary document see N79-10477 01-39)

Avail: NTIS HC A15/MF A01

Strain-controlled, low cycle, fatigue tests on two copper alloys, NARloy Z and 1/2 Hard AMZIRC were performed in argon at 538 C. The tests employed symmetrical triangular, strain waveforms at strain rates from .00004 to .01 to sec to the -1 power in addition to asymmetrical strain waveforms of alternating fast and slow strain rates. Partitioned strainrange versus life relationships were established for both alloys with the Delta epsilon sub cp component of strain being identified as the most severely damaging in each case. The relationships for NARloy Z were then used effectively to predict fatigue life values for hold time tests and for other tests involving asymmetrical waveforms. J.A.M.

N79-10491# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
STRAINRANGE PARTITIONING APPLIED TO Ti-6Al-4V
H. Nowack and J. Vreke *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 12 p refs (For primary document see N79-10477 01-39)
Avail: NTIS HC A15/MF A01

The SRP method was applied at Ti-6Al-4V in a temperature range where significant creep occured (450 C). From the tests with HRSC, TCCR and BCCR cycle types, it was determined that the TCCR and CCCR cycles led to alterations in the mean stress level and that the CCCR type reduced the crack initiation life significantly. The predictions of the SRP method for complex cycles coincided well with the corresponding test results, when the test durations for the HRSC, TCCR, CCCR, and for the complex cycles remained of the same order of magnitude. When the testing time with complex cycles significantly increased, a deviation was observed. Some possible explanations for the observed behavior are given. J.A.M.

N79-10492# Bristol Univ. (England). Dept. of Mechanical Engineering.
STRAINRANGE PARTITIONING IN CYCLIC CREEP OF A 1 Cr-Mo-V STEEL
E. G. Ellison *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 19 p refs (For primary document see N79-10477 01-39)
Avail: NTIS HC A15/MF A01

A 1-Cr-Mo-V ferritic steel was subjected to fatigue/creep conditions at 565 C. Most of the data obtained were from strain controlled tests with and without hold periods. Some load controlled results were also obtained. The strain range partitioning (SRP) method for predicting lives at long hold periods, and under complex load cycles, was applied. With this material, good correlation of data was obtained using the ductility normalized SRP, although even better correlation resulted when the SRP method was modified to take account of the length of the hold period. J.A.M.

N79-10493# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
EXPERIENCES IN THE USE OF STRAINRANGE PARTITIONING FOR PREDICTING TIME DEPENDENT STRAIN-CONTROLLED CYCLIC LIFETIMES OF UNIAXIAL SPECIMENS OF 2 1/4 Cr-1 Mo STEEL, TYPE 316 STAINLESS STEEL, AND HASTELLOY 10
C. R. Brinkman, J. P. Strizak, and M. K. Booker *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 18 p refs Sponsored in part by DOE (For primary document see N79-10477 01-39)
Avail: NTIS HC A15/MF A01

The concept of strainrange partitioning was used to estimate the cyclic life of uniaxial specimens subjected to strain controlled fully reversed cycling at constant temperatures within the creep range. Strain-time waveforms consisted of ramp loading with tension, or compression, or both tension and compression hold periods at peak strain. Materials included 2 1/4 Cr-1 Mo steel in the annealed condition, solution annealed Hastelloy X, and solution annealed, thermally aged, or irradiated type 316 stainless steel. Inelastic strain life relationships were either developed directly from appropriate experimental data or obtained via the ductility normalization concept and used with the interaction damage rule. Generally good agreement between experimental and predicted cyclic lifetimes was found, although a number of uncertainties were identified and discussed. J.A.M.

N79-10494*# Pennsylvania State Univ., University Park. Dept. of Engineering Science and Mechanics.
THE APPLICATION OF STRAINRANGE PARTITIONING METHOD TO MULTIAXIAL CREEP-FATIGUE INTERACTION
S. Y. Zamrik *In* AGARD Characterization of Low Cycle High Temp. Fatigue by the Strainrange Partitioning Method Aug. 1978 26 p refs (For primary document see N79-10477 01-39) (Grant NGR-39-009-034)
Avail: NTIS HC A15/MF A01 CSCL 20K

The method of strain range partitioning was applied to a series of torsional fatigue tests conducted on tubular 304 stainless steel specimens at 1200 F (649 C). Creep strain was superimposed on cycling strain, and the resulting strain range was partitioned into four components: (1) completely reversed plastic shear strain, (2) plastic shear strain followed by creep strain, (3) creep strain followed by plastic strain, and (4) completely reversed creep strain. Each strain component was related to the cyclic life of the material. The experimental procedure used to achieve strain partitioning is described, and the torsional test results are compared to those obtained from axial tests. The damaging effects of the individual strain components were expressed by a linear life fraction rule. J.A.M.

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N79-10495 Georgia Inst. of Tech., Atlanta.
PREDICTION OF PARAMETER VALUES FROM PHYSICAL BASIN CHARACTERISTICS FOR THE US GEOLOGICAL SURVEY RAINFALL-RUNOFF MODEL Ph.D. Thesis
Fred Liscum 1978 400 p
Avail: Univ. Microfilms Order No. 7816662

Calibrations of model parameters available from 228 sites in a six state study area (Alabama, Georgia, Illinois, MIssissippi, Missouri, and Tennessee) were evaluated. The evaluation encompassed the (1)determination of model parameter sensitivity, (2)evaluation of the calibration process, and (3)selection of sites. Thirty basin characteristics were determined for each site. Seventeen described the basin in terms of size, shape, length, width, topography and other physiographic measures. Ten soils characteristics were determined for each site by determining the percent of the total drainage area that was covered by particular soil types. Three climatic characteristics were used that described the precipitation. The model produced acceptable results for watersheds in the study area when predicted parameter values were used. Dissert. Abstr.

N79-10496 Georgia Inst. of Tech., Atlanta.
A CRITERION FOR SELECTING THE PROBABILITY DENSITY FUNCTION OF BEST FIT FOR HYDROLOGIC DATA Ph.D. Thesis
Donthamsetti Veerabhadra Rao 1978 299 p
Avail: Univ. Microfilms Order No. 7817473

Various statistical methods for parameters estimation were examined. The differences between probability density functions (PDF) were determined with emphasis on how the characteristic shapes of the PDF's depend on the value of population variance. The discrepancies between the sample moments and the

moments of the fitted PDF were studied, and the strengths and weaknesses of several potential best fit criteria were identified. It is concluded that the sample moments will generally be approximately equal to the moments of the fitted PDF when the correct, or parent, PDF is fitted by a shape fitting method such as least squares or maximum likelihood or ML. Errors in predictions introduced in frequency analysis by not choosing the 'best' probability density function are larger when computations are made by the likelihood or least squares method than when the computations are made by the method of moments.
Dissert. Abstr.

N79-10497*# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Remote Sensing Programs for Earth Resource Surveys.
MICROWAVE REMOTE SENSING FROM SPACE FOR EARTH RESOURCE SURVEYS
1977 141 p refs
(Contract NASw-3043)
(NASA-CR-157891) Avail: NTIS HC A07/MF A01 CSCL 05B

The concepts of radar remote sensing and microwave radiometry are discussed and their utility in earth resource sensing is examined. The direct relationship between the character of the remotely sensed data and the level of decision making for which the data are appropriate is considered. Applications of active and a passive microwave sensing covered include hydrology, land use, mapping, vegetation classification, environmental monitoring, coastal features and processes, geology, and ice and snow. Approved and proposed microwave sensors are described and the use of space shuttle as a development platform is evaluated. A.R.H.

N79-10498*# National Air and Space Museum, Washington, D. C.
EARTH OBSERVATIONS AND PHOTOGRAPHY EXPERIMENT: SUMMARY OF SIGNIFICANT RESULTS Final Report
Farouk El-Baz 30 Jun. 1978 26 p
(Contract NAS9-13831)
(NASA-CR-157780) Avail: NTIS HC A03/MF A01 CSCL 14E

Observation and photographic data from the Apollo Soyuz Test Project are analyzed. The discussion is structured according to the fields of investigation including: geology, desert studies, oceanography, hydrology, and meteorology. The data were obtained by: (1) visual observations of selected Earth features, (2) hand-held camera photography to document observations, and (3) stereo mapping photography of areas of significant scientific interest. S.B.S.

N79-10499*# National Aeronautics and Space Administration, Washington, D. C.
A COMBINATION OF REMOTE AND GROUND-BASED METHODS FOR STUDYING YOUNG FOLDED DEFORMATIONS IN THE WESTERN KOPETDAG DEPRESSION
T. P. Ivanova and V. G. Trifonov Oct. 1978 18 p refs Transl. into ENGLISH of "Sochetaniye Distantsionnykh i Nazemnykh Metodov Issledovaniya Molodykh Skladchatykh Deformatsii Zapadnogo Pogruzheniya Kopetdaga" Report of the USSR Acad. of Sci., 1975 10 p Translation was announced as N77-13507 Transl. by Agnew Tech-Tran, Inc., Woodland Hills, Calif.
(Contract NASw-2789)
(NASA-TT-F-16953) Avail: NTIS HC A02/MF A01 CSCL 08F

Topographic information obtained from high-altitude photographs is combined with ground-based measurements in an analysis of young folded deformations in the Western Kopetdag depression. Sedimentation patterns obtained from pictures and maps of the area were supplemented by ground-based measurements of cuts in the mountain plain rises and river embankments to determine the history and present development of folded structures. Author

N79-10500*# National Aeronautics and Space Administration, Washington, D. C.
FOREST INVENTORY OF EAST THAILAND USING ERTS-1 AND GROUND TRUTH SURVEY
Darasi Sisaengthong Aug. 1976 35 p refs Transl. into ENGLISH of Rept. No. 750227 Office of the Natl. Sci. Comm. Office of the Min., Bangkok, Sep. 1975 p 1-33 Transl. by Joint Publications Research Service, Arlington
(NASA Order W-13183)
(NASA-TT-F-17065) Avail: NTIS HC A03/MF A01 CSCL 02F

The organization of the project to survey forest areas using LANDSAT 1 photographs is discussed as well as the operation of the satellite itself. Photointerpretation methods are described and discrepancies between the maps based on satellite photographs and ground surveys are examined. A.R.H.

N79-10501*# National Aeronautics and Space Administration, Washington, D. C.
REMOTE SENSING APPLIED TO PROSPECTING OF THERMOMINERAL WATER IN THE COUNTY OF CALDAS NOVAS-GOIAS
Paulo Veneziani and Celio EustaquiodosAnjos Nov. 1978 13 p refs Transl. into ENGLISH of "Sensores Remotos Aplicados a Prospeccao de Aguas Termominerais no Municipio de Caldas Novas-Goias", Rept. INPE-1327-PE/157 Inst. de Pesquisas Espaciais, Sao Paulo, Brazil, Aug. 1978 10 p Presented at the 30th Brazilian Congr. of Geol., Recife, Brazil, 1 Nov. 1978 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75583; INPE-1327-PE/157) Avail: NTIS HC A02/MF A01 CSCL 08H

LANDSAT imagery of the region were studied allowing the placement of the area of study in the regional geological context. A geological mapping of the 1.60.000 scale was done. A methodology was developed which consisted in a regional temperature mapping using trend surface analysis. Through the correlation of all these data, four different areas were localized with a high potential as thermomineral sources. Author

N79-10502*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MINERAL PRECIPITATION IN NORTH SLOPE AUFEIS
Dorothy K. Hall Sep. 1978 10 p refs Submitted for publication
(NASA-TM-79642) Avail: NTIS HC A02/MF A01 CSCL 08G

The Canning and Shaviovik river aufeis fields were studied on the ground and with aircraft data. Powdered calcium carbonate ($CaCO_3$) patches, a few cm in thickness, were found in discrete locations on both aufeis fields. This is indicative of chemical weathering of limestone bedrock which is known to underlie much of the eastern arctic coastal plain of Alaska. Spring or river water which remains unfrozen throughout much of the winter carries $CaCO_3$ in solution; as the river ice freezes more deeply the $CaCO_3$ in solution is forced upwards through cracks in the river ice. Upon exposure to the cold air $CaCO_3$ is excluded as the water freezes, forming successive layers during aufeis growth. In the melt season $CaCO_3$, slush/powder accumulates in patches on top of the ice as the aufeis melts downward.
Author

N79-10503# Arizona Univ., Tucson.
WATER SUPPLY DATA BASE SYSTEM
J. F. Nunamaker, Jr. and D. E. Pingry May 1978 17 p refs
(EPRI-EA-790-SY) Avail: NTIS HC A02/MF A01

This data system has two components, a macro data base and a micro data base. The macro data base contains overview information concerning regions, organizations and data sets and their interrelationship. The micro data base contains the detailed structure of each data set, information describing each and method of accessibility. Data sets containing national and Colorado River Basin specific data are included. These data bases are currently installed on a commercial computer which is accessible through a national communication network. DOE

N79-10504# Los Alamos Scientific Lab., N. Mex.
SOME TECHNIQUES FOR DIGITAL PROCESSING, DISPLAY AND INTERPRETATION OF RATIO IMAGES IN MULTISPECTRAL REMOTE SENSING
G. W. Wecksung and J. R. Breedlove 1977 9 p refs Presented at the Intern. Optical Computing Conf., San Diego, Calif., 25 Aug. 1977

(Contract W-7405-eng-36)
(LA-UR-77-1877; Conf-770844-1) Avail: NTIS HC A02/MF A01

A simple mathematical interpretation of the properties of ratio images derived from LANDSAT and other sources of multispectral imagery is presented. A spectral signature is defined which is well represented by ratios of pairs of spectral bands and can be related to the problem of clustering and unsupervised learning. Some practical problems arising in the generation of LANDSAT ratio images were considered, and an effective, simple method for reduction of the dynamic range of such images is presented along with digital image processing examples. DOE

N79-10505# National Technical Information Service, Springfield, Va.

REMOTE SENSING APPLIED TO ENVIRONMENTAL POLLUTION DETECTION AND MANAGEMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978

Audrey S. Hundemann Aug. 1978 163 p Supersedes NTIS/PS-77/0674 3 Vol.
(NTIS/PS-78/0789/4; NTIS/PS-77/0674) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Application of remote sensing methods to air, water, and noise pollution problems is discussed. Topic areas cover characteristics of dispersion and diffusion by which pollutants are transported, eutrophication of lakes, thermal discharges from electric power plants, outfalls from industrial plants, atmospheric aerosols under various meteorological conditions, monitoring of oil spills, and application of remote sensing to estuarian problems. This updated bibliography contains 156 abstracts, 23 of which are new entries to the previous edition. GRA

N79-10506# National Technical Information Service, Springfield, Va.

REMOTE SENSING APPLIED TO URBAN AND REGIONAL PLANNING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978

Audrey S. Hundemann Aug. 1978 70 p Supersedes NTIS/PS-77/0675 3 Vol.
(NTIS/PS-78/0790/2; NTIS/PS-77/0675) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Urban and regional planning using aerial photography and satellite remote sensing methods is discussed. Abstracts cover the use of remote sensing in land use mapping, traffic surveys and urban transportation planning, and taking inventories of natural resources for urban planning. Abstracts dealing with land use and residential quality associated with acting as an influence on health and physical well being are included. This updated bibliography contains 63 abstracts, 3 of which are new entries to the previous edition. GRA

N79-10507# National Technical Information Service, Springfield, Va.

REMOTE SENSING APPLIED TO GEOLOGY AND MINERALOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1973 - Jul. 1978

Audrey S. Hundemann Aug. 1978 154 p Supersedes NTIS/PS-77/0676 3 Vol.
(NTIS/PS-78/0791/0; NTIS/PS-77/0676) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The use of LANDSAT satellites and other remote sensing methods in geological and mineralogical applications is discussed. Abstracts cover rock and soil mapping, terrain analysis, direct and indirect mineral exploration, fault tectonics, and general geologic studies of various countries. A few abstracts pertain to equipment and techniques used in the studies. This updated bibliography contains 147 abstracts, 25 of which are new entries to the previous edition. GRA

N79-10508# National Technical Information Service, Springfield, Va.

MINE SAFETY. PART 2: COMMUNICATION AND POSITION FINDING SYSTEMS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978

William E. Reed Aug. 1978 89 p Supersedes NTIS/PS-77/0679; NTIS/PS-76/0598; NTIS/PS-75/563
(NTIS/PS-78/0907/2; NTIS/PS-77/0679; NTIS/PS-76/0598; NTIS/PS-75/563) Avail: NTIS HC $28.00/MF $28.00 CSCL 08I

Research reports are cited which cover underground mine communications and trapped miner location. The topics include operational and emergency communication systems, detection and position finding by electromagnetic and seismic means, and electromagnetic noise in mines. This updated bibliography contains 83 abstracts, 9 of which are new entries to the previous edition. GRA

N79-10509# Technicolor Graphic Services, Inc., Sioux Falls, S. Dak.

A SELECTIVE BIBLIOGRAPHY: REMOTE SENSING APPLICATIONS IN LAND USE AND LAND COVER INVENTORY TASKS

William J. Todd Apr. 1978 37 p refs
(Contract DI-14-08-0001-16439)
(PB-283027/1) Avail: NTIS HC A03/MF A01 CSCL 08B

The bibliography contains more than 300 citations of selected publications on the applications of remote sensing techniques to regional and metropolitan land-use and land-cover inventory tasks. Most of the citations were published between January 1968 and June 1977, although some earlier works of continuing interest are included. GRA

N79-10510# National Oceanic and Atmospheric Administration, Washington, D. C. Office of Coastal Zone Management.

STATE OF WISCONSIN COASTAL MANAGEMENT PROGRAM AND FINAL IMPACT STATEMENT

1978 308 p Prepared in Cooperation with Wis. Coastal Management Program, Madison
(PB-283423/2; NOAA-78060522) Avail: NTIS HC A14/MF A01 CSCL 13B

A final environmental impact statement (FEIS) and a program document on the Wisconsin Coastal Management Program are presented. Improved management and regulations are proposed for better air and water quality; the preservation of natural areas and the conservation of wildlife habitat and fisheries; better protection from coastal erosion and flood hazards, balanced community development, increased economic productivity for water dependent activities, better information, and greater public participation in decision-making. GRA

N79-10511# National Oceanic and Atmospheric Administration, Washington, D. C. Office of Coastal Zone Management.

STATE OF RHODE ISLAND COASTAL MANAGEMENT PROGRAM AND FINAL ENVIRONMENTAL IMPACT STATEMENT

Mar. 1978 529 p refs
(PB-283424/0; NOAA-78060516) Avail: NTIS HC A23/MF A01 CSCL 13B

Environmental impacts are described and the responses to the Draft Environmental Impact Statement Comments are presented. Approval and implementation of the program will allow the State to better coordinate and more effectively implement existing State management of its coastal zone. The State will condition, restrict, or prohibit land and water uses in some parts of the Rhode Island coast, while encouraging development in other parts. Each coastal municipality will retain primary responsibility for managing land use along its coast. The impacts will be generally beneficial, although there may be some adverse, short term economic impacts on some coastal users, and the program will entail the irreversible commitment of some coastal resources. GRA

N79-10512# League of Women Voters, Detroit, Mich. Lake Michigan Inter-League Group.

ILLINOIS COASTAL ZONE MANAGEMENT PROGRAM, THIRD YEAR WORK PRODUCT: PUBLIC PARTICIPATION IN THE ILLINOIS COASTAL ZONE MANAGEMENT PROGRAM DEVELOPMENT

Mary Lee Strang 7 Sep. 1977 131 p
(PB-283547/8; NOAA-78060519) Avail: NTIS HC A07/MF A01 CSCL 13B

An executive summary of the public participation activities during the third year planning period by the Lake Michigan Inter-League Group for the Illinois Coastal Zone Management Program is presented. Included are the scheduling, purposes,

and format of the eleven public meetings held by local leagues, as well as a listing and analysis of the questions asked at each of the public meetings. Display boards containing folders about the Illinois Coastal Zone Management Program development were placed at twenty libraries. Various supportive activities were undertaken by the leagues, including a preliminary organization meeting, contacting local newspaper offices with publicity about the public meetings, distribution of over 1000 posters throughout local communities, and local league distribution of the 'Lake Michigan Current'. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N79-10513* National Aeronautics and Space Administration. Pasadena Office, Calif.

DUAL MEMBRANE HOLLOW FIBER FUEL CELL AND METHOD OF OPERATING SAME Patent

John D. Ingham (JPL) and Daniel D. Lawson, inventors (to NASA) (JPL) Issued 11 Jul. 1978 5 p Filed 3 Feb. 1977 Supersedes N77-19581 (15 - 10, p 1336) Sponsored by NASA

(NASA-Case-NPO-13732-1; US-Patent-4,100,331; US-Patent-Appl-SN-765138; US-Patent-Class-429-13; US-Patent-Class-429-41; US-Patent-Class-429-42) Avail: US Patent Office CSCL 10A

A gaseous fuel cell is described which includes a pair of electrodes formed by open-ended, ion-exchange hollow fibers, each having a layer of metal catalyst deposited on the inner surface and large surface area current collectors such as braided metal mesh in contact with the metal catalyst layer. A fuel cell results when the electrodes are immersed in electrolytes and electrically connected. As hydrogen and oxygen flow through the bore of the fibers, oxidation and reduction reactions develop an electrical potential. Since the hollow fiber configuration provides large electrode area per unit volume and intimate contact between fuel and oxidizer at the interface, and due to the low internal resistance of the electrolyte, high power densities can be obtained. Official Gazette of the U.S. Patent Office

N79-10514*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SOLAR TRACKING CONTROL SYSTEM SUN CHASER

D. R. Scott and P. R. White Aug. 1978 17 p Prepared for DOE

(NASA-TM-78199) Avail: NTIS HC A02/MF A01 CSCL 10A

The solar tracking control system, Sun Chaser, a method of tracking the Sun in all types of weather conditions is described. The Sun Chaser follows the Sun from east to west in clear or cloudy weather, and resets itself to the east position after sundown in readiness for the next sunrise. J.M.S.

N79-10515*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.

INDOOR TEST FOR THERMAL PERFORMANCE EVALUATION ON THE NORTHRUP CONCENTRATING SOLAR COLLECTOR

Jul. 1978 29 p Prepared for DOE

(Contract NAS8-32036)

(NASA-CR-150804; WYLE-TR-531-26) Avail: NTIS HC A03/MF A01 CSCL 10A

The test procedure used and the results obtained from an evaluation test program conducted on a Northrup concentrating solar collector under simulated conditions are described. The tests were made using the Marshall Space Flight Center's solar simulator. A time constant test and incident angle modifier test were also conducted to determine the transient effect and the incident angle effect on the collector. The Northrup concentrating solar collector is a water/glycol/working fluid type, with a dipped galvanized steel housing, transparent acrylic Fresnel lens cover, copper absorber tube, and fiber glass insulation. It weighs approximately 98 pounds. The gross collector area is about 29.4 sq ft per collector. A collector assembly includes four collector units within a tracking mount array. S.B.S.

N79-10516*# General Electric Co., Philadelphia, Pa.

SOLAR HEATING AND COOLING SYSTEM DESIGN AND DEVELOPMENT Status Summary, Apr. - Jun. 1978

Jul. 1978 43 p Prepared for DOE

(Contract NAS8-32092)

(NASA-CR-150803) Avail: NTIS HC A03/MF A01 CSCL 10A

The development of eight prototype solar heating and combined heating and cooling systems is reported. Manufacture, test, installation, maintenance, problem resolution, and monitoring the operation of prototype systems is included. Heating and cooling equipment for single family residential and commercial applications and eight operational test sites (four heating and four heating and cooling) is described. J.M.S.

N79-10517*# Artech Corp., Falls Church, Va.

THERMAL ENERGY STORAGE SUBSYSTEMS Quarterly Reports, 1 Jan. - 30 Jun. 1978

Jan. 1978 17 p Prepared for DOE

(Contract NAS8-32254)

(NASA-CR-150812) Avail: NTIS HC A02/MF A01 CSCL 10A

Progress made in the development, fabrication, and delivery of thermal energy storage, are discussed. J.M.S.

N79-10518*# Rademaker (Richard L.), Corp., Louisville, Kentucky.

SOLAR SYSTEM INSTALLATION AT LOUISVILLE, KENTUCKY Final Report

7 Aug. 1978 105 p

(Contract E(49-18)-2385)

(NASA-CR-150814) Avail: NTIS HC A06/MF A01 CSCL 10A

The installation of a solar space heating and domestic hot water system is described. The overall philosophy used was to install both a liquid and a hot air system retrofitted to existing office and combined warehouse building. The 1080 sq. ft. office space is heated first and excess heat is dumped into the warehouse. The two systems offer a unique opportunity to measure the performance and compare results of both air and liquid at one site. J.M.S.

N79-10519*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

COST ANALYSIS OF NEW AND RETROFIT HOT-AIR TYPE SOLAR ASSISTED HEATING SYSTEMS

Rodney D. Stewart and Billy J. Hawkins Aug. 1978 33 p refs Sponsored in part by DOE

(NASA-TM-78186) Avail: NTIS HC A03/MF A01 CSCL 10A

A detailed cost analysis/cost improvement study was performed on two Department of Energy/National Aeronautics and Space Administration operational test sites to determine actual costs and potential cost improvements of new and retrofit hot air type, solar assisted heating and hot-water systems for single family sized structures. This analysis concentrated on the first cost of a system which included procurement, installation, and integration of a solar assisted heating and hot water system on a new or retrofit basis; it also provided several cost projections which can be used as inputs to payback analyses, depending upon the degree of optimism or future improvements assumed. Cost definitions were developed for five categories of cost, and preliminary estimates were developed for each. The costing methodology, approach, and results together with several candidate low cost designs are described. Author

N79-10520*# Colt, Inc. of Southern California, Rancho Mirage. Energy Systems Div.

PRELIMINARY DESIGN PACKAGE FOR SOLAR HEATING AND HOT WATER SYSTEM

Dec. 1976 69 p refs Prepared for DOE

(Contract NAS8-32242)
(NASA-CR-150619) Avail: NTIS HC A04/MF A01 CSCL 10A

Two prototype solar heating and hot water systems for use in single-family dwellings or commercial buildings were designed. Subsystems included are: collector, storage, transport, hot water, auxiliary energy, and government-furnished site data acquisition. The systems are designed for Yosemite, California, and Pueblo, Colorado. The necessary information to evaluate the preliminary design for these solar heating and hot water systems is presented. Included are a proposed instrumentation plan, a training program, hazard analysis, preliminary design drawings, and other information about the design of the system. S.B.S.

N79-10521*# Wyle Labs., Inc., Huntsville, Ala. Solar Energy Systems Div.
THERMAL PERFORMANCE EVALUATION OF THE CALMAC (LIQUID) SOLAR COLLECTOR
H. Usher 23 Jun. 1978 28 p refs Prepared for DOE
(Contract NAS8-32036)
(NASA-CR-150819; WYLE-TR-531-25) Avail: NTIS HC A03/MF A01 CSCL 10A

The procedures used and the results obtained during the evaluation test program on the S. N. 1, (liquid) solar collector are presented. The flat plate collector uses water as the working fluid. The absorber plate is aluminum with plastic tubes coated with urethane black. The glazing consists of .040 in fiberglass reinforced polyester. The collector weight is 78.5 pounds with overall external dimensions of approximately 50.3in. x 98.3in. x 3.8in. The following information is given: thermal performance data under simulated conditions, structural behavior under static loading, and the effects of long term exposure to natural weathering. These tests were conducted using the MSFC Solar Simulator. S.B.S.

N79-10522*# Alabama Univ., University. Dept. of Physics and Astronomy.
DEVELOPMENT OF SURFACES OPTICALLY SUITABLE FOR FLAT SOLAR PANELS Final Report
Donald DeSmet and Andrew Jason [1978] 46 p refs
(Contract NAS8-32481)
(NASA-CR-150831) Avail: NTIS HC A03/MF A01 CSCL 10A

Three areas of research in the development of flat solar panels are described. (1) A reflectometer which can separately evaluate the spectral and diffuse reflectivities of surfaces was developed. The reflectometer has a phase locked detection system. (2) A coating composed of strongly bound copper oxide that is formed by an etching process performed on an aluminum alloy with high copper content was also developed. Because of this one step fabrication process, fabrication costs are expected to be small. (3) A literature search was conducted and conclusions on the required optical properties of flat plate solar collectors are presented. S.B.S.

N79-10523*# Northrup, Inc., Hutchins, Tex.
DESIGN PACKAGE FOR CONCENTRATING SOLAR COLLECTOR PANELS
Aug. 1978 228 p Prepared for DOE
(Contract NAS8-32251)
(NASA-CR-150788) Avail: NTIS HC A11/MF A01 CSCL 10A

Information used to evaluate the design of the Northrup concentrating collector is presented. Included are the system performance specifications, the applications manual, and the detailed design drawings of the collector. The collector is a water/glycol/working fluid type, with a dipped galvanized steel housing, transparent acrylic Fresnel lens cover, copper absorber tube, and fiber glass insulation. It weights 98 pounds. A collector assembly includes four collector units within a tracking mount array. S.B.S.

N79-10524*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RANKINE CYCLE MACHINES FOR SOLAR COOLING
Hoyt M. Weathers Aug. 1978 17 p Prepared for DOE
(NASA-TM-78196) Avail: NTIS HC A02/MF A01 CSCL 10A

Research, development, and demonstration of Rankine cycle machines are outlined that use fluids heated by solar energy rather than by coal, petroleum, natural gas, or nuclear fuels.G.G.

N79-10525*# United Technologies Corp., Windsor Locks, Conn.
DESIGN, FABRICATION, AND TEST OF A COMPOSITE MATERIAL WIND TURBINE ROTOR BLADE Final Report
D. G. Griffee, Jr., R. E. Gustafson, and E. R. More Nov. 1977 185 p refs
(Contracts NAS3-19773; E(49-26)-1028)
(NASA-CR-135389; DOE/NASA/9773-78/1; HSER-7383) Avail: NTIS HC A09/MF A01 CSCL 10A

The aerodynamic design, structural design, fabrication, and structural testing is described for a 60 foot long filament wound, fiberglass/epoxy resin matrix wind turbine rotor blade for a 125 foot diameter, 100 kW wind energy conversion system. One blade was fabricated which met all aerodynamic shape requirements and was structurally capable of operating under all specified design conditions. The feasibility of filament winding large rotor blades was demonstrated. Author

N79-10526*# AiResearch Mfg. Co., Phoenix, Ariz.
MINI-BRU/BIPS 1300 We DYNAMIC POWER CONVERSION SYSTEM DEVELOPMENT: EXECUTIVE SUMMARY
Sep. 1978 25 p refs
(Contract NAS3-18517)
(NASA-CR-159440; AiResearch-31-2937) Avail: NTIS HC A02/MF A01 CSCL 10B

The status of the Brayton Isotope Power System (BIPS) is summarized. A 1200 watt sub e ground development unit was built and tested in a 0.000010 torr vacuum environment. Peformance mapping and 1000 hours of proof of concept system testing were completed. Specific components, primarily turbocompressor/alternator and recuperator performed according to predictions, thus achieving the design goal of 25 percent net power conversion efficiency. The system was fabricated from superalloy (Hastelloy-X and Waspaloy) thus placing it entirely within current state-of-the-art technology. The system could be flyable in the early 1980's pending flight qualification. J.M.S.

N79-10527*# Henningan (Thomas J.) Assoc., West Hyattsville, Md.
SEALED SILVER-OXIDE CADMIUM BATTERIES FOR SPACE FLIGHT, 1960 - 1977
Thomas J. Hennigan Apr. 1978 298 p refs
(NASA Order S-34087-B)
(NASA-CR-156838) Avail: NTIS HC A13/MF A01 CSCL 10C

A technical summary of design, development, and test activities with Silver-Oxide Cadmium Batteries at the Goddard Space Flight Center since 1960 is given. The flight experience of over 15 missions has demonstrated the sealed Silver-Oxide Cadmium Battery to be a viable energy storage device for missions requiring ultra-clean magnetic environment. L.S.

N79-10528# Levelton (B. H.) and Associates Ltd., Vancouver (British Columbia).
AN EVALUATION OF WOOD-WASTE ENERGY CONVERSION SYSTEMS
B. H. Levelton Environ. Canada Western Forest Products Lab. 31 Mar. 1978 199 p refs
Avail: NTIS HC A09/MF A01 CSCL 10A

The British Columbia Wood Waste Energy Co-Ordinating Commission was formed to evaluate the potential increased use of wood waste as an energy source in British Columbia. As part of this program, the committee commissioned a study of the technology available for recovering energy from wood waste and evaluation of the merits of various systems available for energy recovery. The terms of reference of the study may be summarized as follows: (1) identify potential applications in the forest-products industry for wood-waste fuels to replace fossil fuels; (2) identify and assess the relative merits of the various classes of systems for wood energy conversion; and (3) identify and evaluate specific existing commercial and pilot-scale systems for wood-energy conversion with emphasis on all possible end uses of each system. G.Y.

N79-10529*# National Aeronautics and Space Administration. Pasadena Office, Calif.

AN IMPROVED SOLAR CELL MODULE Patent Application
Neal Franklin Shepard, Jr., inventor (to NASA) (GE Corp., Philadelphia) Filed 29 Sep. 1978 10 p Sponsored by NASA (Contract JPL-954607)
(NASA-Case-NPO-14467-1; US-Patent-Appl-SN-946994) Avail: NTIS HC A02/MF A01 CSCL 10A

A concentrator for a solar cell module with the capability of achieving significant concentration of incidence flux without resorting to the use of ancillary concentration devices is described. The concentrator is adapted to employ repeated internal reflection for effectively concentrating solar energy onto the active surfaces of the solar cells of the module. The solar cell module is characterized by an internally reflective transparent cover plate, a planar surface of incidence, and a diffusively reflective textured surface with at least one silicon solar cell bonded at its active surface to a portion of the textured surface. Thus, incident solar flux striking the surface of incidence is re-reflected internally off the cover plate until incident upon the active surface of the solar cell occurs. NASA

N79-10530# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
ENERGY DEVELOPMENT FROM ELEMENTAL TRANSMUTATIONS IN BIOLOGICAL SYSTEMS Final Report, Dec. 1977 - Apr. 1978
S. Goldfein May 1978 27 p refs
(AD-A056906; MERADCOM-2247) Avail: NTIS HC A03/MF A01 CSCL 07/2

The purpose of the study was to determine whether recent disclosures of elemental transmutations occurring in biological entities have revealed new possible sources of energy. The works of Kervran, Komaki, and others were surveyed; and it was concluded that, granted the existence of such transmutations (Na to Mg, K to Ca, and Mn to Fe), then a net surplus of energy was also produced. A proposed mechanism was described in which Mg adenosine triphosphate, located in the mitochondrion of the cell, played a double role as an energy producer. In addition to the widely accepted biochemical role of MgATP in which it produces energy as it disintegrates part by part, MgATP can also be considered to be a cyclotron on a molecular scale. The MgATP when placed in layers one atop the other has all the attributes of a cyclotron in accordance with the requirements set forth by E. O. Lawrence, inventor of the cyclotron. It was concluded that elemental transmutations were indeed occurring in life organisms and were probably accompanied by a net energy gain. Author (GRA)

N79-10531# Naval Surface Weapons Center, White Oak, Md.
BATTERY SEPARATOR FROM POLYPHENYLQUINOXALINE POLYMER BLENDS Research and Development Report, Jun. - Dec. 1977
Isaac Angres Apr. 1978 22 p refs
(AD-A056881; NSWC/WOL/TR-78-56) Avail: NTIS HC A02/MF A01 CSCL 10/3

This work was performed to determine if polyphenylquinoxaline blends with polymers such as polyvinylacetate, cellulose acetate, can be made into polymeric membranes useful as battery separators. It was found that polyphenylquinoxaline and cellulose acetate blends offer the best membrane useful as battery separators. Author (GRA)

N79-10532# Ecoview, Napa, Calif.
DIRECT HEAT APPLICATIONS OF GEOTHERMAL ENERGY IN THE GEYSERS/CLEAR LAKE REGION, VOLUME 2: ENVIRONMENTAL ASSESSMENT Final Report
Aug. 1977 266 p
(Contract EG-77-C-03-1326)
(SAN-1326-1/2) Avail: NTIS HC A12/MF A01

Environmental assessments of each of the six study areas are presented under the following headings: general aspects; air resource status and quality; water resource-status quality; vegetation resource;and faunal resource. The six areas are:(1)Borax Lake - Burns Valley, Sulphur Bank Mine Valley, and High Valley;(2)Mt. Konocti - Thurston Lake; (3)Colloyami Valley - Ford Flat Area,(4)High Valley Creek - Glenbrook Area;(5)Calistoga Geothermal Area; and(6)Geysers Geothermal Field. DOE

N79-10533# West Virginia Univ., Morgantown.
DESIGN, INSTRUMENTATION, AND CALIBRATION OF A VERTICAL AXIS WIND TURBINE ROTOR M.S. Thesis
D. G. Elko 1977 112 p refs
(Contract EY-76-C-05-5135)
(TID-27754) Avail: NTIS HC A06/MF A01

A vertical axis wind turbine designed strictly for research purposes, in order to confirm theoretical performance calculations is described. Aerodynamic performance and structural analysis are emphasized. DOE

N79-10534# Oak Ridge Associated Universities, Tenn.
NET ENERGY ANALYSIS OF FIVE ENERGY SYSTEMS
A. M. Perry, W. D. Devine, Jr., A. E. Cameron, G. Marland, H. Plaza, D. B. Reister, N. L. Treat, and C. E. Whittle Sep. 1977 156 p refs
(Contract EY-76-C-05-0333)
(ORAU/IEA(R)-77-12) Avail: NTIS HC A08/MF A01

Ocean thermal energy conversion, wind energy conversion, in-situ oil shale processing, fluidized-bed coal combustion, and municipal solid-waste utilization are analyzed. Energy expenditures required during construction and life-long operation and maintenance are estimated using input-output and process analyses. These expenditures, including both direct and indirect consumption, are classified as capital or operating expenditures and as expenditures for electric or nonelectric inputs to the systems. Various ratios that compare the anticipated energy product of a system to its estimated energy subsidy are defined. Dissimilar technologies cannot be compared on the basis of these performance indices. The indices indicate all of the systems considered are net producers of energy, and decisions to proceed with deployment and development should be based on other considerations. DOE

N79-10535# Institute of Gas Technology, Chicago, Ill.
FEASIBILITY STUDY OF TRANSPORTING OFFSHORE OTEC-PRODUCED ENERGY TO SHORE BY THERMAL MEDIA. PROJECT 8980 Topical Report, Nov. 1976 - Jul. 1977
B. Yudow, A. Konopka, and N. Biederman Oct. 1977 112 p refs
(Contract EX-76-C-01-2426)
(DSE/2426-19) Avail: NTIS HC A06/MF A01

Thermal-energy media were considered as both methods of storage and of transportation of OTEC-derived energy. Three types of thermal-energy storage media were considered for transport of OTEC energy: (1) sensible-heat media, which depend upon the heat capacity of the material for energy storage; (2) latent heat of fusion materials; and (3) reversible chemical reactions, which depend upon the change in energy content of certain compounds as chemical bonds are broken and other bonds are made. The characteristics of the storage medium, configuration, and materials, the system energy storage density, system thermal losses, heat-engine efficiency, and cycle temperature are specified. The unit capital costs of storage, transport ships, and heat engines are also discussed. The methodology for the economic evaluation of the thermal-energy transport system is also described. DOE

N79-10536# California Univ., Berkeley. Earth Sciences Div.
GEOTHERMAL RESERVOIR ENGINEERING MANAGEMENT PROGRAM PLAN (GREMP PLAN)
Oct. 1977 142 p refs
(Contract W-7405-eng-48)
(LBL-7000) Avail: NTIS HC A07/MF A01

A plan for the development of the geothermal resources of the United States is presented. Six major elements are identified to make up the research program structure. These are: properties of materials; definition of reservoir characteristics; description of example reservoirs; modeling the behavior of geothermal systems; exploitation strategies; and economics. The six elements yield twelve research categories and fifty research projects. These are discussed in detail and summarized in a table. DOE

N79-10537# Argonne National Lab., Ill.
NATIONAL COAL UTILIZATION ASSESSMENT: AN INTEGRATED ASSESSMENT OF INCREASED COAL USE IN THE MIDWEST: IMPACTS AND CONSTRAINTS, VOLUME 1

Oct. 1977 107 p
(Contract W-31-109-eng-38)
(ANL/AA-11-Vol-1-Draft) Avail: NTIS HC A06/MF A01

The impacts of increased coal utilization in 14 northern midwestern states were examined to ensure that environmental and social concerns receive appropriate emphasis. Strategies to alleviate potential problems or constraints associated with coal utilization were identified. Areas examined were: technology characteristics; energy supply and demand trends; siting constraints on coal-related facilities; impacts of increased coal use on water availability, land use, and coal reserves; impacts on air and water quality and ecosystem; effects of trace-element emissions from coal combustion/conversion; social and economic impacts; and health risks. Significant emphasis was placed on identifying the coal-related problems and risks that are of particular concern to state and regional agencies and commissions. DOE

N79-10538# Mitre Corp., McLean, Va. METREK Div.
SYSTEM FOR PROJECTING THE UTILIZATION OF RENEWABLE RESOURCES. SPURR METHODOLOGY
K. Rebibo, G. Bennington, P. Curto, P. Spewak, and R. Vitray Sep. 1977 38 p refs
(Contract EY-76-C-01-2322)
(ERHQ/2322-77/4) Avail: NTIS HC A03/MF A01

The program SPURR consists of a computer simulation model and an energy data base containing engineering cost data on solar and conventional technologies in: heating and cooling of buildings, process heat, electric utility, and production of synthetic fuels and products. The model simulates on a year by year basis the market decisions to purchase solar (or other new energy options) and conventional technologies in each of the four market sectors in each region of the U.S. to satisfy a given energy demand. The simulation accounts for regional differences in climate, fuel costs and energy demand; cost reductions on new technologies based on projected experience; and certain interactions among the market sectors. Market decision algorithms were developed that incorporate probability of least cost; technological substitution limited by an S-shaped curve; market shares based on the relative value of competing technologies as well as the perceived risk of the new technology; and a boom or bust phenomenon. DOE

N79-10539# Sandia Labs., Albuquerque, N. Mex.
SOLAR POWERED IRRIGATION: PRESENT STATUS AND FUTURE OUTLOOK
L. L. Lukens, R. L. Alvis, and A. M. Perino 1978 8 p refs Presented at 4th Energy Symp., Los Angeles, 23 May 1978
(Contract EY-76-C-04-0789)
(SAND-78-0016C; Conf-780527-1) Avail: NTIS HC A02/MF A01

Experiments in New Mexico and Arizona are described. The New Mexico experiment is constructed near Willard, New Mexico. It produce approximately 25 hp continuously during the irrigation season to direct drive a turbine-type well pump which delivers enough water to irrigate 100 acres. It utilizes 6720 sq ft (625 m sq) of distributive-type solar collectors to heat an oil heat transfer fluid. The hot fluid produced supplies a Rankine cycle engine and charges a unique design thermocline thermal storage system. Data from these experiments are utilized in a systems and application analysis. Optimal applications and designs for the important agricultural regions of the US are defined. The annualized costs of solar irrigation systems are compared to the annualized costs of conventional irrigation techniques. The economics of present systems are about a factor of four higher than conventional sources, but future systems designed for mass production look better. DOE

N79-10540# Los Alamos Scientific Lab., N. Mex.
HOT DRY ROCK ENERGY PROJECT
R. H. Hendron 1977 26 p refs Presented at Alternative Energy Sources Symp., Miami Beach, Fla., 5 Dec. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2744; Conf-771203-5) Avail: NTIS HC A03/MF A01

A proof-of-concept experimental project to establish the feasibility of exploitation of the thermal energy contained in the earth's crust where such energy and a transporting fluid have not been juxtaposed in nature is described. A region of high heat flow and apparently unfaulted basement rock formation was selected. Two boreholes, drilled to a total depth of about 3 km (10,000 ft) and penetrating about 2.5 km (7500 ft) into the Precambrian formation, to a rock temperature of 200 C, were connected at depth by a hydraulically fractured zone to form the heat extraction surface. Energy was extracted at a rate of 3.2 MW(t) with water temperature of 132 C during a 96-h preliminary circulating test run. The progress of the project, procedures, salient events, reports, and specialized topics are presented. DOE

N79-10541# Oak Ridge National Lab., Tenn. Energy Div.
ENERGY AVAILABILITIES FOR STATE AND LOCAL DEVELOPMENT: 1973 DATA VOLUME
D. P. Vogt, P. L. Rice, and V. P. Pai Nov. 1977 268 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5890-S2) Avail: NTIS HC A12/MF A01

The supply, demand, and net imports of seven fuel types for four final consuming sectors of BEAs, states, census regions, and the nation in 1974 is presented. The data were formatted to present regional energy availability from primary extraction as well as from regional transformation processes. As constructed, the tables depict energy balances between availability and use for each of the specific fuels. DOE

N79-10542# Oak Ridge National Lab., Tenn. Energy Div.
ENERGY AVAILABILITIES FOR STATE AND LOCAL DEVELOPMENT: 1974 DATA VOLUME
D. P. Vogt, P. L. Rice, and V. P. Pai Nov. 1977 269 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5890-S3) Avail: NTIS HC A12/MF A01

Energy demand in 1973 for four final consuming sectors as well as domestic supply and net imports of seven fuel types are presented in the form of energy balance statements for each of these geographic regions. The regional energy statements developed present a consistent format for monitoring and reporting changes in historic and projected energy availability and consumption patterns. Marginal changes in energy availability were generally measured at the national level. B.B.

N79-10543# Department of Energy, Morgantown, W. Va. Morgantown Energy Research Center.
FLUIDIZED-BED COMBUSTION TEST OF LOW-QUALITY FUELS: TEXAS LIGNITE AND LIGNITE REFUSE
J. S. Mei, U. Grimm, and J. S. Halow Apr. 1978 48 p refs
(MERC/RI-78/3) Avail: NTIS HC A03/MF A01

Samples of Texas lignite from the Wilcox formation were investigated to assess this fuel as a potential feedstock for fluidized bed combustors. Combustion tests were performed over a wide range of operating conditions to develop fluidized bed combustion (FBC) engineering and emissions data on this low-quality fuel. Combustion characteristics observed include: no clinker formation at bed temperature as high as 2000 F, high sulfur retention capability of the mineral from lignite at bed temperature below 1600 F, and freeboard burning of carryover less than expected. Results indicate that lignite may be a particularly attractive solid fuel for industrial FBC applications. One potential problem with the use of this fuel is the formation of very fine ash particles which are difficult to retain in the bed. Use of an attrition resistant bed material was required to maintain bed inventory. DOE

N79-10544# Department of Energy, Washington, D. C. Div. of Energy Storage Systems.
HYDROGEN ENERGY STORAGE PROGRAM: FIVE-YEAR PLAN
Apr. 1978 56 p refs
(DOE/ET-0046) Avail: NTIS HC A04/MF A01

Major topics discussed include production studies in electrolysis, thermochemical cycles, and advanced concepts; advancement of metal hydride and occluder material hydrogen storage methods, both stationary and vehicular applications; and underground hydrogen storage. Hydrogen use in the industrial, residential and commercial, and electric and natural gas utilities sectors is addressed along with containment materials for hydrogen and safety in hydrogen operations. DOE

N79-10545# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN (EDP). OIL SUPPLY, FY 1977
May 1978 178 p refs
(DOE/EDP-0024) Avail: NTIS HC A09/MF A01

This oil supply EDP briefly describes the petroleum technology. The environmental, health, and safety issues and the environmental activities needed to resolve these issues are identified. An action plan for the evaluation and mitigation of environmental impacts, as well as a schedule for review and update of NEPA (National Environmental Policy Act) documents, are presented. The coordination and management strategy for conducting the environmental research program is discussed. This is the first Oil Supply EDP and it will be updated annually to take into account the progress of the technologies toward commercialization, the environmental work accomplished by ERDA and other agencies, the resolution of outstanding environmental issues concerning the technologies and identification of decision points which require compliance with NEPA. DOE

N79-10546# Department of Energy, Washington, D. C. Div. of Energy Storage Systems.
BATTERY AND ELECTROCHEMICAL SYSTEMS PROGRAM SUMMARY, FY 1977
W. H. Webster, ed. Apr. 1978 156 p
(DOE/ET-0014) Avail: NTIS HC A08/MF A01

During FY 1977, STOR committed $13.3 million of its funds to electrochemical programs, and managed an additional $5.6 million for the Division of Transportation Energy Conversion to develop near-term batteries for electric vehicles. This publication consists of summaries of all these programs, including contractors, major sub-contracts, names of program managers, funding, and a brief description of the objectives and status of each program. DOE

N79-10547# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
RELIABILITY OF WIND POWER FROM DISPERSED SITES: A PRELIMINARY ASSESSMENT
Edward Kahn Apr. 1978 46 p refs
(Contract W-7405-eng-48)
(LBL-6889) Avail: NTIS HC A03/MF A01

The reliability benefit of geographically dispersed wind turbine generators is analyzed. Electricity produced from wind machines experienced wide fluctuations of output at a given site. The conventional wisdom on wind power suggested that it is unrealistic to expect that wind generation will be sufficiently reliable to displace conventional capacity. DOE

N79-10548# California Univ., Berkeley. Lawrence Berkeley Lab.
DISCUSSION OF HEAT MIRROR FILM: PERFORMANCE, PRODUCTION PROCESS, AND COST ESTIMATES
B. P. Levin and P. E. Schumacher 4 Oct. 1977 84 p refs
(LBL-7812) Avail: NTIS HC A05/MF A01

Intrex film is a transparent, electrically conductive plastic, film originally developed as a component in electrically heatable, transparent products such as deicing windshields for aircraft, locomotives, and the like. The electrical conductivity is imparted to the plastic film by the vacuum deposition of a thin film of gold onto one surface. This gold film exhibits typical luminous transmittance of 80% and sheet resistivity of 10 ohms per square. The properties, heat mirror performance, production and cost of Intrex film for window coating were studied. Intrex film was found to have optical properties which make it suitable for heat mirror window applications when used as the interior component of double layer glazing. The cost of the film in various quantities was demonstrated to be low enough to make such heat mirrors economical. Possible modifications of Intrex films to improve heat mirror performance are discussed. Several alternate approaches for lower cost heat mirror windows are explored, including other metals, semiconducting oxides and multilayer polymers. Abrasion corrosion resistant coatings for Intrex and their effect on heat mirror performance are also discussed. Author

N79-10549# Argonne National Lab., Ill. Energy and Environmental Systems Div.
PARAMETRIC STUDY OF TURBINE SYSTEMS FOR COMPRESSED AIR ENERGY STORAGE PLANTS
Final Report
Choong S. Kim and George T. Kartsounes Apr. 1978 45 p refs
(Contract W-31-109-eng-38)
(ANL/ES-64) Avail: NTIS HC A03/MF A01

A parametric study of possible turbine systems for compressed air energy storage plants was made. The plant considered is divided into four subsystems: (1) a turbine system; (2) compressor system; (3) reversible motor/generator; and (4) an underground air storage reservoir. The turbine system comprises a high pressure gas turbine, a low pressure gas turbine, two combustors, and a recuperator. The compressor system consists of a low pressure compressor, a booster compressor, an intercooler, and an aftercooler. A water compensated mined cavern is the underground reservoir. Thermodynamic analyses of subsystem components are made, and plant performance evaluated. The results are given in terms of the five parameters: specific air flow rate, specific storage volume, specific heat rate, specific compression rate, and overall plant efficiency. The effects on plant performance of design parameters such as inlet gas temperature and pressure to each turbine were analyzed. Also considered was the effect of using cooling air for turbine blades and vanes. DOE

N79-10550# Sandia Labs., Albuquerque, N. Mex.
STATUS OF THE DOE PHOTOVOLTAIC CONCENTRATOR TECHNOLOGY DEVELOPMENT PROJECT
M. W. Edenburn, D. G. Schueler, and E. C. Boes 1978 12 p refs Sponsored by DOE
(SAND-78-0948C; Conf-780619-4) Avail: NTIS HC A02/MF A01

The project activities for the production of low-cost photovoltaic power by taking advantage of sunlight concentrators that replace high-cost photovoltaic cells with lower cost reflective or refractive optical surfaces are presented. The project includes developing solar cells designed for high-solar-intensity applications; finding and developing promising concentrator concepts; developing components for use in concentrators such as reflective and refractive optical devices, cell encapsulants, cell cooling mechanisms, and low-cost sun-tracing structures; testing and evaluating arrays and array components; studying various aspects of photovoltaic concentrators such as the effects of nonuniform illumination, shading, cell temperature gradients and cell cooling; developing manufacturing techniques for large-scale array production; and supporting the fabrication of full-sized arrays. S.B.S.

N79-10551# Department of Energy, Washington, D. C. Div. of Power Systems.
IMPROVED CONVERSION EFFICIENCY WORKSHOP. VOLUME 2: SUMMARY
Dominic J. Monetta, ed. 1977 41 p refs Workshop held at Pipestem, W. Va., 16-18 Oct. 1977
(CONF-771003-P2-Vol-2) Avail: NTIS HC A03/MF A01

The proceedings of the workshop are given. Three major areas of discussion are: engines, heating systems, and waste heat recovery. Summaries of the panel discussion on these topics are included. Conclusions and recommendations resulting from the workshop are outlined for research and development projects, federal involvement, funding, and indirect effects of conservation methods. S.B.S.

N79-10552# National Technical Information Service, Springfield, Va.
ENERGY CONSERVATION: POLICIES, PROGRAMS AND GENERAL STUDIES. A BIBLIOGRAPHY WITH ABSTRACTS
Progress Report, 1964 - Jun. 1978
Audrey S. Hundemann Jul. 1978 220 p Supersedes NTIS/PS-77/0506; updates NTIS/PS-75/214
(NTIS/PS-78/0693/8; NTIS/PS-77/0506; NTIS/PS-75/214)
Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

National policies, programs, and general studies of ways to conserve energy are reviewed. Topic areas cover such subjects as electric load management, effects of price and taxation on energy conservation, public attitudes and behavior toward energy saving, energy savings through reduction in hot water consump-

tion, and telecommunications substitutability for travel. This bibliography contains 216 abstracts. GRA

N79-10553# National Technical Information Service, Springfield, Va.
SOLAR PONDS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Jun. 1978
Audrey S. Hundemann Aug. 1978 31 p Updates NTIS/PS-77/0458
(NTIS/PS-78/0836/3; NTIS/PS-77/0458) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

This bibliography contains 27 abstracts of federally-funded research reports on the design, performance, and use of solar ponds. Topic areas cover the use of solar ponds in industrial process heat production, roof ponds for passive solar buildings, and solar pond use in the production of biomass for renewable fuels. GRA

N79-10554# National Technical Information Service, Springfield, Va.
SOLAR PONDS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1978
Audrey S. Hundemann Aug. 1978 34 p Updates NTIS/PS-77/0459
(NTIS/PS-78/0837/1; NTIS/PS-77/0459) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

The design and use of solar ponds for industrial process heat production and in space heating applications are discussed in 25 abstracts from worldwide literature. A few citations pertain to solar pond stability and evaporation rates. GRA

N79-10555# AiResearch Mfg. Co., Torrance, Calif.
STUDY OF FLYWHEEL ENERGY STORAGE VOLUME 1: EXECUTIVE SUMMARY Final Technical Report
L. J. Lawson, A. K. Smith, and G. D. Davis 1 Sep. 1977 123 p refs 5 Vol.
(Contract DOT-UT-60097T)
(PB-282652/7; UMTA-CA-06-0106-77-1-Vol-1) Avail: NTIS HC A06/MF A01; also available in set of 5 reports HC E14 as PB-282651-SET CSCL 13F

The practically and viability of flywheel propulsion systems for urban mass transit vehicles was studied. The U.S. transit properties requirements show that the most suitable vehicle for deployment of flywheel propulsion is the full-size transit bus. Several propulsion concepts were hypothesized and subjected to comparative analysis with present diesel buses, trolley coaches, and battery buses in regard to performance and life-cycle economics. The following basic concepts could provide high quality transit service: pure flywheel propelled bus; flywheel/diesel engine hybrid bus; flywheel-augmented trolley coach; and flywheel/battery hybrid bus. Design studies conducted for the four propulsion configurations show a high degree of commonality of components among the four concepts. Final life-cycle cost analyses show all four concepts to be in a competitive range with present transit vehicles. GRA

N79-10556# AiResearch Mfg. Co., Torrance, Calif.
STUDY OF FLYWHEEL ENERGY STORAGE. VOLUME 2: SYSTEMS ANALYSIS Final Technical Report
L. J. Lawson, A. K. Smith, and G. D. Davis 1 Sep. 1977 244 p refs 5 Vol.
(Contract DOT-UT-60097T)
(PB-282653/5; UMTA-CA-06-0106-77-2-Vol-2) Avail: NTIS HC A11/MF A01; also available in set of 5 reports HC E14 as PB-282651-SET CSCL 13F

The requirements for improved rubber-tired urban transit vehicles are reviewed and identified. Three baseline vehicles are described: a 40-ft diesel bus, a trolley coach, and a battery bus. The requirement needs of 11 transit properties are also discussed. GRA

N79-10557# AiResearch Mfg. Co., Torrance, Calif.
STUDY OF FLYWHEEL ENERGY STORAGE. VOLUME 3: SYSTEM MECHANIZATION Final Technical Report
L. J. Lawson, A. K. Smith, and G. D. Davis 1 Sep. 1977 157 p refs 5 Vol.
(Contract DOT-UT-60097T)
(PB-282654/3; UMTA-CA-06-0106-77-3-Vol-3) Avail: NTIS HC A08/MF A01; also available in set of 5 reports HC E14 as PB-282651-SET CSCL 13F

The practicality and viability of flywheel propulsion systems for urban mass transit vehicles was studied. Several propulsion concepts were hypothesized and subjected to comparative analysis with present diesel buses, trolley coaches, and battery buses in regard to performance and life-cycle economics. The results of the system mechanization are presented for the four flywheel propulsion configurations that scored highest in the screening: pure flywheel drive; flywheel/battery hybrid drive; flywheel/diesel engine hybrid drive; and flywheel-augmented trolley coach drive. GRA

N79-10558# AiResearch Mfg. Co., Torrance, Calif.
STUDY OF FLYWHEEL ENERGY STORAGE. VOLUME 4: LIFE-CYCLE COSTS Final Technical Report
L. J. Lawson, A. K. Smith, and G. D. Davis 1 Sep. 1977 110 p refs 5 Vol.
(Contract DOT-UT-60097T)
(PB-282655/0; UMTA-CA-06-0106-77-4-Vol-4) Avail: NTIS HC A06/MF A01; also available in set of 5 reports HC E14 as PB-282651-SET CSCL 13F

Four flywheel vehicles were studied to determine the practicality and viability of flywheel propulsion systems for urban mass transit. The vehicles were: a pure flywheel propelled bus; a flywheel/diesel engine hybrid bus; a flywheel-augmented trolley coach; and a flywheel/battery hybrid bus. The methodology developed to guide the life cycle cost analysis of the flywheel vehicles as compared with three baseline vehicles is described. GRA

N79-10559# AiResearch Mfg. Co., Torrance, Calif.
STUDY OF FLYWHEEL ENERGY STORAGE. VOLUME 5: VEHICLE TESTS Final Technical Report
L. J. Lawson, A. K. Smith, and G. D. Davis 1 Sep. 1977 91 p refs 5 Vol.
(Contract DOT-UT-60097T)
(PB-282656/8; UMTA-CA-06-0106-77-5-Vol-5) Avail: NTIS HC A05/MF A01; also available in set of 5 reports HC E14 as PB-282651-SET CSCL 13F

The major results of tests performed on a 40-foot diesel bus and a trolley coach as related to determining the practicality and viability of flywheel propulsion systems for urban mass transit vehicles are presented. Test data from the 20-vehicle M.A.N. Electrobus demonstration program in Germany are included. GRA

N79-10560# Energy and Environmental Analysis, Inc., Arlington, Va.
END USE ENERGY CONSUMPTION DATA BASE: SERIES 1 TABLES
Washington DOE Jun. 1978 219 p refs Prepared in cooperation with Faucett (Jack) Associates, Inc., Chevy Chase, Md., and Ultrasystems, Inc., McLean, Va.
(Contract DOE-CO-03-60412-00; DOE-CO-03-50346-00; DOE-CO-03-60410)
(PB-281817/7; DOE/EIA-0014; DOE/CRN-780106-00003) Avail: NTIS HC A10/MF A01 CSCL 10A

A series of tables are presented which categorize national energy consumption in 1974 by economic sector, by major industries within certain sectors, by end use, by fuel, and by geographic area. For the transportation sector, there is a breakout by mode of transportation. For the residential sector, there are breakouts by type of housing structure and by the income level of the residents. GRA

N79-10561# Department of Transportation, Washington, D. C. Research and Special Programs Administration.
ENERGY IN TRANSPORTATION
May 1978 44 p refs
(PB-282928/1; DOT-RSPA-DPB-20-78-13) Avail: NTIS HC A03/MF A01 CSCL 10A

Near-term transportation energy demand, vehicle design considerations, and transportation energy conservation opportunities are presented. Current and projected energy demand in the transportation modes and their relative energy efficiencies are given. Various vehicle and propulsion systems are described, along with several examples of potentially more efficient propulsion

technologies that are in development. The estimated effectiveness of various energy conservation opportunities are summarized. GRA

N79-10562# Illinois Energy Resources Commission, Springfield.
SOLID WASTE AND BIOMASS. THEIR POTENTIAL AS ENERGY SOURCES IN ILLINOIS, 1977
Harold L. Koenig 1977 54 p refs
(PB-281649/4) Avail: NTIS HC A04/MF A01 CSCL 13B

The Solid Waste and Biomass Study Panel was established in April, 1976, to prepare a comprehensive report describing current programs, problems, and recent technical developments pertaining to the conversion to fuel of solid waste and biomass. The panel was also directed to recommend legislative action, as well as educational and research programs, that could be undertaken by the state to encourage the development of solid waste and biomass as sources of energy for the state. The panel's recommendations are described in this report. GRA

N79-10563# General Electric Co., Schenectady, N. Y.
A STUDY OF FLYWHEEL ENERGY STORAGE FOR URBAN TRANSIT VEHICLES Final Report
Sep. 1977 213 p refs
(Contract DOT-UT-60096T)
(PB-282929/9; UMTA-NY-06-0062-77-1) Avail: NTIS HC A10/MF A01 CSCL 13F

The use of flywheel storage as applied to fixed-route, multistop, and rubber-tired urban transit vehicles was studied. The application of flywheel energy storage to a broad spectrum of electrically powered urban transit vehicles was also studied. Charts, tables, major conclusions and recommendations are provided. System requirements; flywheel/motor energy storage packages; life-cycle cost analysis, methodology, and worksheets; modularity in design; and a list of references are included. GRA

N79-10564# Florida Agricultural and Mechanical Univ., Tallahassee.
ENERGY: THE NEW ECONOMIC DEVELOPMENT WILD-CARD Final Report
Shirley P. Burggraf Jan. 1978 59 p refs Presented at White House Conf. on Balanced Natl. Growth and Economic Development
(Grants EDA-99-7-13426; EDA-PF-612)
(PB-282494/4; EDA/OER-78-024) Avail: NTIS HC A04/MF A01 CSCL 10A

Contrary to the general impression that energy is a specifically national issue, emerging evidence indicates that energy is a function of geography to a surprising degree. The purpose of this report is to address such topics as: (1) the possibility of forecasting the effect of energy on the national economy, (2) the likelihood of energy causing serious economic dislocations by becoming a significant factor in location and survival of firms, and (3) the size of the interregional income transfers due to energy, the probability of energy causing the economically advantaged states or regions of the country to get richer and the disadvantaged poorer, or the opposite influence. GRA

N79-10565# Department of Energy, Washington, D. C. Energy Information Administration.
COMPREHENSIVE OVERVIEW OF WINTER ENERGY DATA BULLETINS Annual Report, Nov. 1977 - Mar. 1978
Jun. 1978 413 p
(PB-282787/1; DOE/EIA-0058; CRN-780531-00226) Avail: NTIS HC A18/MF A01 CSCL 10A

Winter Energy Data Bulletins (WEDB) provide information concerning energy related problems that affect the public throughout the winter. The WEDBs contain demand and supply information for coal, natural gas, and refined petroleum products, as well as temperature accumulations and weather forecasts. GRA

N79-10566# National Technical Information Service, Springfield, Va.
SOLAR ENERGY CONCENTRATOR DESIGN AND OPERATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Jun. 1978
Audrey S. Hundemann Aug. 1978 104 p Updates NTIS/PS-77/0458
(NTIS/PS-78/0838/9; NTIS/PS-77/0458) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

Government-funded research on the design and operation of various types of solar energy concentrators is discussed. Abstracts cover the efficiency and optimization of Fresnel lenses, V-trough concentrators, flat plate and parabolic reflectors, compound parabolic concentrators used in solar photovoltaic conversion, and heliostat systems. A few abstracts deal with heat loss and coast studies. This bibliography contains 97 abstracts. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N79-10567 Arizona State Univ., Tempe.
QUANTITATIVE ELECTRON MICROPROBE ANALYSIS OF AIRBORNE PARTICULATE MATERIAL, PARTS 1 AND 2 Ph.D. Thesis
John Thomas Armstrong 1978 766 p
Avail: Univ. Microfilms Order No. 7814670

Theoretical corrections are developed which enable quantitative analysis of individual microparticles using electron beam instruments. These correction equations calculate the amount of electron transmission, backscatter, sidescatter and X-ray production, absorption, and secondary fluorescence in particles of given sizes and idealized geometric shapes. Analyses of particles of known composition indicate that the various geometric models chosen in the development on the correction equations well predict the magnitude of the effect of particle size and shape on observed relative X-ray intensities. Applications of quantitative individual particle analysis in air pollution research are discussed. Results of quantitative analyses of a variety of particles from ambient and source samples in the Phoenix metropolitan area and other selected locations in Arizona are presented. Dissert. Abstr.

N79-10568 City Univ. of New York.
AN ANALYSIS OF THE NEW YORK CITY AEROSOL FOR TRACE ELEMENT CONSTITUENTS USING PROTON INDUCED X-RAY EMISSON SPECTROSCOPY Ph.D. Thesis
Sene Ellis Bauman 1978 103 p
Avail: Univ. Microfilms Order No. 7816121

Samples were collected using cascade impactors whose 50% stage collection efficiency diameters were 16, 8, 4, 2, 1, and 0.5 micrometers and whose stages were modified by using Mylar instead of glass as the impaction surface. Chemical analyses for S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Cu, Zn, Br, and Pb were performed by Proton Induced X-Ray Emission Spectroscopy (PIXE), using the Brooklyn College Dynamiltron linear accelerator to generate the 3.0 MeV protons used in this method. The PIXE system which was developed in the course of this work described in detail. Dissert. Abstr.

N79-10569 California Inst. of Tech., Pasadena.
METHODS FOR SULFATE AIR QUALITY MANAGEMENT WITH APPLICATIONS TO LOS ANGELES, VOLUMES 1 AND 2 Ph.D. Thesis
Glen Rowan Cass 1978 854 p
Avail: Univ. Microfilms Order No. 7815977

The technical understanding needed for sulfate air quality control strategy design is developed. Methods which link sulfate air quality and air quality impacts on visibility to the cost of controlling sulfur oxides air pollutant emissions are presented. These techniques are tested by application to the Los Angeles Basin over the years 1972 through 1974. An air quality simulation model is developed which directly calculates long-term average sulfate concentrations under unsteady meteorological conditions. Pollutant concentrations are estimated from Lagrangian marked-particle statistics based on the time sequence of historical measured wind speed, wind direction and inversion base height motion. First order chemical reactions and ground level pollutant dry deposition are incorporated within a computational scheme which conserves pollutant mass. Dissert. Abstr.

N79-10570* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SMOKESTACK-MOUNTED AIRFOIL Patent
Robert C. Costen, inventor (to NASA) Issued 11 Jan. 1978 12 p Filed 10 Nov. 1975 Supersedes N76-13419 (14 - 04, p 0449)
(NASA-Case-LAR-11669-1; US-Patent-4,099,452; US-Patent-Appl-SN-630582; US-Patent-Class-98-58; US-Patent-Class-239-2R; US-Patent-Class-239-14; US-Patent-Class-110-184; US-Patent-Class-114-187) Avail: US Patent Office CSCL 13B

A system for improving the effluent dispersal characteristics of smokestacks subject to relative winds comprising a vortex generating airfoil attached to a smokestack near the stack gas exit is described. Relative winds passing over the airfoil create strong vortices which entrain and hold together smokestack effluents until the vortices deteriorate. The vortex flow direction and angle of ascension is controlled in order to achieve optimum effluent dispersal by varying the airfoil angle of attack.
Official Gazette of the U.S. Patent Office

N79-10571# California Univ., Livermore. Lawrence Livermore Lab.
ASTRONOMICAL TECHNIQUES APPLIED TO POLLUTION DETECTION. 2: CHEMICAL COMPOSITIONS BY VISIBLE EXTINCTION
T. R. Galloway, Joseph Waidl, and William M. Porch Oct. 1977 6 p refs Presented at the Joint Conf. on Sensing of Environ. Pollutants, New Orleans, 6-11 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-79485; Conf-771113-2) Avail: NTIS HC A02/MF A01

A technique was developed in which chemical composition information for atmospheric pollutants can be derived from telescopic measurements of the photometric extinction of stellar and local light sources in the visible wavelengths. An atmospheric model was developed which relates the broad-band extinction spectrum to the sum of the individual atmospheric constituent extinctions. The model includes constituents such as inversion layer ozone, nitrogen oxides, natural and photochemical aerosols, stratospheric ozone and aerosols, water vapor, and Rayleigh molecular absorption. The anomalous red hump in extinction appears to be explained. Mie scattering theory was used to invert the aerosol spectral extinction results to produce particle size distribution curves. These distributions together with composition information were used to infer the possible sources, such as automotive emission, combustion, marine aerosols, and natural dirt. High-resolution extinction spectroscopy was undertaken to explore the species natural form of the photochemical species in the urban inversion layer. Ideas are presented on how these techniques can be used in an automated optical atmospheric monitoring station. DOE

N79-10572# Department of Energy, Washington, D. C. Div. of Environmental Control Technology.
ENVIRONMENTAL CONTROL TECHNOLOGY ACTIVITIES OF THE DEPARTMENT OF ENERGY IN FY 1977
Nov. 1977 88 p refs
(DOE/EV-0030) Avail: NTIS HC A05/MF A01

Activities to balance energy goals with environmental requirements to protect and enhance the general health, safety, and welfare of the nation are described. Environmental effects and mitigating measures that can be taken are considered. Only ERDA research, funding, development, and demonstration activities are covered. DOE

N79-10573# Environmental Protection Agency, Washington, D. C. Div. of Stationary Source Enforcement.
COMPLIANCE STATUS OF MAJOR AIR POLLUTION FACILITIES Final Report
May 1978 696 p refs
(PB-281694/0; EPA-340/1-78-006) Avail: NTIS HC A99/MF A01 CSCL 13B

The probable compliance status and related facility information for major stationary sources of air pollution are presented. This report is not intended to represent the true legal status of facilities with respect to applicable air pollution regulations but rather those facilities of interest to the states or EPA for further investigation. GRA

N79-10574# Stanford Research Inst., Menlo Park, Calif.
PRELIMINARY ENVIRONMENTAL ASSESSMENT OF ENERGY CONVERSION PROCESSES FOR AGRICULTURAL AND FOREST PRODUCT RESIDUES, VOLUME 1 Final Report
Benjamin J. Gikis, F. Alan Ferguson, Jerry L. Jones, M. C. T. Kuo, and Clyde L. Witham Mar. 1978 181 p refs
(Contract EPA-68-01-2940)
(PB-281189/1; EPA-600/7-78-047-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 13B

The environmental impacts of several types of conversion processes for producing energy or fuels from agricultural and forestry residues were assessed. Fifteen examples were selected to represent various combinations of agricultural residues and conversion processes available in various geographic regions. The conversion processes included gasification-pyrolysis, liquefaction-pyrolysis, combustion (direct firing, both large and small scale), co-combustion with coal, and anaerobic digestion. Residues included animal manure, forestry and field crops, including sugar cane. Special attention was given to pesticide and herbicide residues in conversion processes. GRA

N79-10575# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
AIR QUALITY DATA: 1976 ANNUAL STATISTICS INCLUDING SUMMARIES WITH REFERENCE TO STANDARDS Annual Report, 1976
Mar. 1978 477 p refs
(PB-282212/0; EPA-450/2-78-009) Avail: NTIS HC A21/MF A01 CSCL 13B

The data are summarized in two formats: frequency distributions (Part 1) and status of data with reference to standards (Part 2). These summaries are based on data acquired through extensive monitoring activities conducted by Federal, state, and local pollution control agencies and submitted to the U.S. Environmental Protection Agency's National Aerometric Data Bank. Information is provided on the six pollutants for which National Ambient Air Quality Standards were set: total suspended particulates, carbon monoxide, sulfur dioxide, nitrogen dioxide, total hydrocarbons, and total oxidants. GRA

N79-10576# National Technical Information Service, Springfield, Va.
ELECTROSTATIC PRECIPITATORS FOR AIR POLLUTION CONTROL CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Aug. 1978
Diane M. Cavagnaro Aug. 1978 218 p Supersedes NTIS/PS-77/0821; NTIS/PS-76/0752; NTIS/PS-75/587
(NTIS/PS-78/0912/2; NTIS/PS-77/0821; NTIS/PS-76/0752; NTIS/PS-75/587) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

Citations on the design, performance, theory, and applications of electrostatic precipitators for use in air pollution control are presented. Both industrial and electric power plants are included. This updated bibliography contains 213 abstracts. GRA

N79-10577# National Technical Information Service, Springfield, Va.
ELECTROSTATIC PRECIPITATORS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX BASE Progress Report, 1975 - Aug. 1978
Diane M. Cavagnaro Aug. 1978 293 p Supersedes NTIS/PS-77/0822; NTIS/PS-76/0754
(NTIS/PS-78/0913/0; NTIS/PS-77/0822; NTIS/PS-76/0754) Avail: NTIS HC $28.00/MF $28.00 CSCL 07A

Citations of worldwide research on the design, performance, theory, installation methods, and principal applications for air pollution control equipment in industrial plants are presented. This updated bibliography contains 288 abstracts. GRA

N79-10578# National Technical Information Service, Springfield, Va.
AIR POLLUTION ECONOMICS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - 1976

Diane M. Cavagnaro 1978 136 p 2 Vol.
(NTIS/PS-78/0797/7) Avail: NTIS HC $28.00/MF $28.00 CSCL 05C

The economics of air pollution control and management are covered, including the economics involved with industrial waste treatment, urban planning, government planning, and automobile and mass transportation. Specific cost studies are excluded, unless they apply to an industry or entire region. This updated bibliography contains 129 abstracts, none of which are new entries to the previous edition. GRA

N79-10579# National Technical Information Service, Springfield, Va.
AIR POLLUTION ECONOMICS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Jul. 1978
Diane M. Cavagnaro Aug. 1978 38 p Supersedes NTIS/PS-77/0781; NTIS/PS-76106-64; NTIS/PS-75/535; NTIS/PS-74/091 2 Vol.
(NTIS/PS-78/0798/5; NTIS/PS-77/0781; NTIS/PS-76/0664; NTIS/PS-75/535; NTIS/PS-74/091) Avail: NTIS HC $28.00/MF $28.00 CSCL 05C

This bibliography contains studies on the economics of air pollution control and management but excludes cost studies unless they apply to an industry or entire region. The citations include the economics involved with industrial waste treatment, urban planning, government planning, and automobile and mass transportation. This updated bibliography contains 231 abstracts, 155 of which are new entries to the previous edition. GRA

N79-10580# National Technical Information Service, Springfield, Va.
CHEMICAL ANALYSIS OF AEROSOLS AND AIRBORNE PARTICULATES, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964-1976
Diane M. Cavagnaro Aug. 1978 181 p
(NTIS/PS-78/0755/5) Avail: NTIS HC $28.00/MF $28.00 CSCL 07D

Research is presented on the chemical analysis and composition of aerosols and airborne particulate matter. Techniques discussed range from chromatography to various methods of activation and spectroscopic analysis. Particle sampling techniques and particle size analysis are excluded. This updated bibliography contains 174 abstracts, none of which are new entries to the previous edition. GRA

N79-10581# National Technical Information Service, Springfield, Va.
CHEMICAL ANALYSIS OF AEROSOLS AND AIRBORNE PARTICULATES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Jul. 1978
Diane M. Cavagnaro Aug. 1978 108 p Supersedes NTIS/PS-77/0717; NTIS/PS-76/0617; NTIS/PS-75/527; COM-74-11018
(NTIS/PS-78/0756/3; NTIS/PS-77/0717; NTIS/PS-76/0617; NTIS/PS-75/527; COM-74-11018) Avail: NTIS HC $28.00/MF $28.00 CSCL 07D

This bibliography presents the chemical analysis and composition of aerosols and airborne particulate matter, but excludes particle sampling techniques and size analysis. Some of the techniques that are covered include chromatography, activation analysis, and spectroscopic analysis. This bibliography contains 101 abstracts, 54 of which are new entries to the previous edition. GRA

N79-10582# Midwest Research Inst., Kansas City, Mo.
FUGITIVE EMISSIONS FROM INTEGRATED IRON AND STEEL PLANTS Final Report, Jun. 1975 - Jun. 1977
Russel Bohn, Thomas Cuscino, Jr., and Chatten Cowherd, Jr. Mar. 1978 262 p refs
(Contract EPA-68-02-2120)
(PB-281322/8; EPA-600/2-78-050) Avail: NTIS HC A12/MF A01 CSCL 13B

Fugitive (non-ducted) emissions in the iron and steel industry were investigated. Fugitive emission factors for iron and steel sources were compiled from the literature and from contact with industry sources. Field testing of particulate emissions from materials handling operations and from traffic on paved and unpaved roads was utilized to develop improved emission factors for open fugitive emission sources. Ranking fugitive sources on the basis of typically controlled fugitive emissions of fine particulates indicates that electric furnaces, vehicular traffic, basic oxygen furnaces, storage pile activities, and sintering, in decreasing order, are the most important sources of fugitive emissions studied. Results show that substantial progress has been made in developing devices and methods for emission capture and removal. However, major problems exist in retrofitting proposed systems to existing operations. There is also a serious lack of data on uncontrolled emission quantities, control device effectiveness, and control costs. GRA

N79-10583# California Univ., Santa Barbara. Marine Science.
OIL SPILL AND OIL POLLUTION REPORTS, VOLUME 5, NUMBER 1 Quarterly Report, Nov. 1977 - Jan. 1978
Helmut Ehrenspeck, Penelope Melvin, Elizabeth Sorenson, and James Cook Apr. 1978 204 p
(Grant EPA-R-805052)
(PB-281671/8; EPA-600/2-78-071) Avail: NTIS HC A10/MF A01 CSCL 13B

The November 1977-January 1978 issue begins Volume 5 of Oil Spill and Oil Pollution Reports, a quarterly compilation of abstracts of current oil pollution-related literature and research projects. Comprehensive coverage of terrestrial and aquatic oil pollution and its prevention and control is provided, with emphasis on the marine environment. The report contains (1) citations and summaries of 1975 to 1977 publications and patents; (2) status and summaries of current research programs; and (3) information on current oil pollution-related meetings. GRA

N79-10584# National Technical Information Service, Springfield, Va.
URBAN AIR POLLUTION, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Jul. 1978
Diane M. Cavagnaro Jul. 1978 215 p Supersedes NTIS/PS-77/0651; NTIS/PS-76/0584; NTIS/PS-75/545; NTIS/PS-74/104
(NTIS/PS-78/0699/5; NTIS/PS-77/0651; NTIS/PS-76/0584; NTIS/PS-75/545; NTIS/PS-74/104) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

Selected reports are cited on urban air pollution and its abatement. These citations were selected because of their general interest to urban planners, which will enable them to become aware of new abatement strategies and techniques. The majority of the studies cover various aspects of transportation emissions. Other optics include health standards, atmospheric models to aid in planning, law enforcement, abatement policies, and the effects of new modes of transportation. This updated bibliography contains 209 abstracts. GRA

N79-10585# National Technical Information Service, Springfield, Va.
AIR QUALITY MONITORING, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - 1976
Diane M. Cavagnaro Aug. 1978 291 p
(NTIS/PS-78/0757/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

The bibliography cites research reports on air pollution monitoring, including site selection, operation criteria, design criteria, calibration, and the performance evaluation of the technique or equipment. The monitoring of different types of pollutants from various sources is covered. This updated bibliography contains 284 abstracts, none of which are new entries to the previous edition. GRA

N79-10586# National Technical Information Service, Springfield, Va.
AIR QUALITY MONITORING, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Jul. 1978
Diane M. Cavagnaro Aug. 1978 182 p Supersedes NTIS/PS-77/0727; NTIS/PS-76/0639; NTIS/PS-75/529; COM-74-11360
(NTIS/PS-78/0758/9; NTIS/PS-77/0727; NTIS/PS-76/0639; NTIS/PS-75/529; COM-74-11360) Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

These citations of Federally-funded research discuss studies on air pollution monitoring, including site selection, operation criteria, design criteria, calibration, and the performance evaluation of the technique or equipment. Different types of pollutants from various sources are covered. This updated bibliography contains 175 abstracts, 97 of which are new entries to the previous edition. GRA

N79-10587# Midwest Research Inst., Kansas City, Mo.
CHEMICAL TECHNOLOGY AND ECONOMICS IN ENVIRONMENTAL PERSPECTIVES. TASK 2: INVESTIGATION OF ALTERNATIVES TO CHLOROFLUOROCARBONS IN SELECTED AEROSOL PRODUCTS Final Report
Thomas W. Lapp, Howard Gadberry, Gary L. Lelso, Richard O. Welch, and Fritz Hoffmeister Mar. 1978 50 p refs
(Contract EPA-68-01-3896)
(PB-281948/0; EPA-560/1-78-002) Avail: NTIS HC A03/MF A01 CSCL 13B

Several aerosol propellant applications of chlorofluorocarbons were examined to identify existing and technologically feasible alternatives. Associated cost factors were also considered. The applications examined were: agents for latent fingerprint development, anti-spatter compounds for welding, aerosol spray to produce smoke or fog, spray mold release agent for medicine tablets, leather spray polish preservative, high voltage spray insulation, clipper coolants and lubricants, moisture removal spray, engine degreasers, electric shaver cleaners and lubricants, aircraft deodorant spray, products for the airline industry, and contact cleaner/lubricant. GRA

N79-10588# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: RUBBER PROCESSING, STATE OF THE ART Final Task Report
C. T. Chi, T. W. Hughes, T. E. Ctvrtnicek, D. A. Horn, and R. W. Serth Mar. 1978 135 p refs
(Contract EPA-68-02-1874)
(PB-281423/4; MRC-DA-730; EPA-600/2-78-004J) Avail: NTIS HC A07/MF A01 CSCL 13B

Data on air emissions from the production of vulcanized elastomers (rubbers)and fabrication of rubber products are summarized. Source severity is defined as the ratio of the time-averaged maximum ground level concentration of a pollutant emitted from a representative plant, to the ambient air quality standard(for criteria pollutants)or to a reduced threshold limit value (for noncriteria pollutants). Source severities greater than or equal to one were found. For the following operations: the butadiene absorption vent in emulsion SBR production, the drying operation in solution SBR production, green tire spraying and c ring operations in the tire industry, and rubber cementing in the rubber footwear industry. GRA

N79-10589# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: CRUSHED LIMESTONE, STATE OF THE ART Final Task Report, Aug. 1975 - Feb. 1976
P. K. Chalekode, T. R. Blackwood, and S. R. Archer Apr. 1978 65 p refs
(Contract EPA-68-02-1874)
(PB-281422/6; MRC-DA-747; EPA-600/2-78-004E) Avail: NTIS HC A04/MF A01 CSCL 13B

Atmospheric emissions from the crushed limestone industry were studied. Crushed limestone plants emit particulates from drilling, blasting, transport on unpaved roads, crushing, screening, conveying, and stockpiling. The emission factor for total particulate from a representative plant producing 450 metric tons/hr of product is 3.5 g/metric ton. Vehicular movement on unpaved roads contributes 66% of the overall emissions and approximately 38% of the respirable particulate emissions. The hazardous constituent in the dust is free silica(1.2% by weight). Nitrogen oxides and carbon monoxide are emitted by the blasting operation, but their emission factors are small in comparison to that of particulate emissions. The maximum source severity for particulates is 0.032 for free silica; in the respirable particulate emissions, it is 0.12. GRA

N79-10590# California Univ., Santa Barbara. Marine Science Inst.
OIL SPILL AND OIL POLLUTION REPORTS Quarterly Report, Aug. - Oct. 1977
Penelope Melvin, Helmut Ehrenspeck, and Elizabeth Sorenson Jan. 1978 291 p
(Grant EPA-R-805052)
(PB-281114/9; EPA-600/2-77-111) Avail: NTIS HC A13/MF A01 CSCL 13B

The August 1977 - October 1977 issue of Oil Spill and Oil Pollution Reports is a quarterly compilation of oil pollution publications and ongoing project summaries. Presented in the report are: (1) summaries and citations of published literature and patents; (2) summaries and status of current research projects; and (3) current oil-related conferences. GRA

N79-10591# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
PARTICULATE AND SULFUR DIOXIDE EMISSION CONTROL COSTS FOR LARGE COAL-FIRED BOILERS Final Report
Larry L. Gibbs, Duane S. Rorste, and Yatendra M. Shah Feb. 1978 168 p refs
(Contract EPA-68-02-2535)
(PB-281271/7; EPA-450/3-78-007) Avail: NTIS HC A08/MF A01 CSCL 13B

Cost cases developed included five processes; lime, limestone, mag-ox, double alkali, and Wellman-Load: Also included are five plant sizes from 25-1000 MW; three SO2 control levels, current, 90% efficiency, 0.5 lbs SO2/million Btu; three particulate levels, current (43 ng/j), 22 ng/j, and 13 ng/j; and coals of varying sulfur, heating value, and ash content. Averaging times, redundancy, sludge disposal, and energy penalties are also studied. GRA

N79-10592# Charles River Associates, Inc., Cambridge, Mass.
REGIONAL MANAGEMENT OF AUTOMATIVE EMISSIONS: THE EFFECTIVENESS OF ALTERNATIVE POLICIES FOR LOS ANGELES Final Report
Frederick J. Dunbar Dec. 1977 301 p refs
(Contract EPA-68-01-2235)
(PB-281213/9; EPA-600/5-77-014) Avail: NTIS HC A14/MF A01 CSCL 13B

A relatively quick and reliable method is developed for estimating the cost effectiveness of travel related policies. The methods used include application of a behavorial demand model for automobile travel by mode, purpose and destination, and a model which predicts the size of the auto stock and its age distribution. These models are used to compute the costs to society and individual travelers of various policies, and to compute the emission reduction effects of various policies. In applying these procedures to Los Angeles, the following specific strategies were evaluated: (1) increased gas taxes; (2) taxes on vehicle emissions per mile based on odometer readings and emissions tests; (3) nonresidential parking surcharges; (4) extensions of route miles by conventional bus, and (5) annual taxes based on vehicle model, make and year. GRA

N79-10593# Air Pollution Technology, Inc., San Diego, Calif.
EVALUATION OF FOUR NOVEL FINE PARTICULATE COLLECTION DEVICES Final Report, Jul. 1974 - Dec. 1977
S. Calvert, S. C. Yung, H. Barbarika, and R. G. Patterson Mar. 1978 121 p refs
(Contract EPA-68-02-1496)
(PB-281320/2; EPA-600/2-78-062) Avail: NTIS HC A06/MF A01 CSCL 13B

Results are given of an experimental performance evaluation of four novel fine particulate control devices: (1) the Johns-Manville Cleanable High Efficiency Air Filtration (CHEAF) System, (2) the APS Electrostatic Scrubber, (3) the APS Electrotube, and (4) the TRW Charged Droplet Scrubber. The evaluations included measurement of inlet and outlet particle size distribution and concentration with cascade impactor and diffusion battery. Fine particle collection efficiencies were computed from the data, as functions of particle size. Mathematical performance models were developed for the CHEAF system and the APS scrubber. The models gave satisfactory predictions. GRA

N79-10594# McIlvaine Co., Northbrook, Ill.
RESEARCH AND DEVELOPMENT AND COST PROJECTIONS FOR AIR POLLUTION CONTROL EQUIPMENT

Final Report, Aug. 1977 - Jan. 1978
R. W. McIlvaine and Marilyn Ardell Jun. 1978 32 p refs
(PB-283021/4; EPA-600/7-78-092) Avail: NTIS HC A03/MF A01 CSCL 07A

Projections for the installed cost of fabric filters and electrostatic precipitators (ESPs) for the removal of particulate matter and for the installed cost of scrubbers for the removal of both particulates and sulfur oxides are given. The projections, utilizing a large and unique data base, project the installed cost of the equipment annually through the year 1982. Similar projections are made for annual research and development expenditures by manufacturers of scrubbers, ESPs, and fabric filtration systems. Differences between the reported projections and those made routinely by other organizations are explained. GRA

N79-10595# Hittman Associates, Inc., Columbia, Md.
STANDARDS OF PRACTICE MANUAL FOR THE SOLVENT REFINED COAL LIQUEFACTION PROCESS Final Report, Apr. - Nov. 1977
P. J. Rogoshewski, P. A. Koester, C. S. Koralek, R. S. Wetzel, and K. J. Shields Jun. 1978 372 p refs
(Contract EPA-68-02-2162)
(PB-283028/9; EPA-600/7-78-091) Avail: NTIS HC A16/MF A01 CSCL 07A

The manual gives an integrated multimedia assessment of control/disposal options, emissions, and environmental requirements associated with a hypothetical 50,000 bbl/day Solvent Refined Coal (SRC) facility producing gaseous and liquid fuels. It gives an overall outline of the basic system, including module descriptions and summaries on pollution concurrently available and developing control/disposal practices that may be applicable to waste streams from coal liquefaction technologies. In the detailed definition of the basic system, it describes modules in detail, and quantities input and output streams. GRA

N79-10596# Missouri Water Resources Center, Rolla.
THE ROLE OF SURFACE MICROLAYER OF WATER IN THE DISTRIBUTION AND FATE OF TRACE ORGANIC CONTAMINANTS: A FEASIBILITY STUDY
J. F. Stampfer and D. Vincent Roach Apr. 1978 19 p refs
(Contract DI-14-31-0001-7053)
(PB-281749/2; W78-07319; OWRT-A-098-MO(1)) Avail: NTIS HC A02/MF A01 CSCL 13B

The transport of materials from the water surface to aerosols produced by bursting bubbles was investigated. When the bubbles break rapidly upon reaching the surface no net concentration effect is found, indeed the concentration of materials in the jet drops is usually less than that of the solution. When the bubbles reside on the surface before breaking, a concentration of the surface materials is noticed in the jet drops. The amount present can be up to 15 times the amount present in the same volume solution. GRA

N79-10597# Pacific Northwest Environmental Research Lab., Corvallis, Ore. Assessment and Criteria Development Div.
TIME SERIES EXPERIMENTS FOR STUDYING PLANT GROWTH RESPONSE TO POLLUTION Progress Report, Apr. 1974 - Sep. 1977
Larry Male, John VanSickle, and Ray Wilhour Apr. 1978 26 p refs
(PB-282885/3; EPA-600/3-78-038) Avail: NTIS HC A03/MF A01 CSCL 06F

A model for simulating realistic fluctuations in SO2 air pollution was developed. This model was used to design experiments in field growth chambers for the purpose of establishing the functional and probabilistic relationship between yield loss and median SO2 concentration. The stochastic experiments are a viable alternative to traditional long-term fixed concentration experiments. GRA

N79-10598# Environmental Health Associates, Inc., Berkeley, Calif.
HEALTH EFFECTS OF DIESEL EXHAUST EMISSIONS: A COMPREHENSIVE LITERATURE REVIEW, EVALUATION AND RESEARCH GAPS ANALYSIS
Donald V. Lassiter and Thomas H. Milby 25 Jan. 1978 204 p refs Sponsored in part by the American Mining Congress
(PB-282795/4) Avail: NTIS HC A10/MF A01 CSCL 06T

A comprehensive literature review of the human health consequences of exposure to diesel exhaust emissions, especially as encountered in underground mines is presented. The toxicology of diesel exhaust both as a mixture and as individual toxicants was examined. In a properly ventilated mine, neither CO, SO2, nor NO2 were found to be major toxic problems. Polycyclic aromatic hydrocarbon (PAH) compounds were identified as the most potentially hazardous agents found in diesel engine exhaust. Although a properly maintained diesel engine would be likely to emit extremely small amounts of these agents, the possibility that they might be carcinogenic to humans singles them out for careful attention. GRA

N79-10599# Environmental Sciences Research Lab., Research Triangle Park, N.C.
ATMOSPHERIC DISPERSION PARAMETERS IN PLUME MODELING Progress Report, Jan. - Aug. 1977
F. Pasquill May 1978 70 p refs
(PB-283655/9; EPA-600/4-78-021) Avail: NTIS HC A04/MF A01 CSCL 04A

The underlying foundations of systems for specification of atmospheric dispersion parameters for a continuous point source were surveyed. Recommendations for changes on the crosswind spread are presented. A suggested revision for vertical spread as a function of surface roughness and stability is given. The convective velocity scale and mixing depth, is recommended for the unstable case. GRA

N79-10600# Oak Ridge National Lab., Tenn.
REVIEWS OF THE ENVIRONMENTAL EFFECTS OF POLLUTANTS. 3: CHROMIUM Final Report
Leigh E. Towill, Carole R. Shriner, John S. Drury, Anna S. Hammons, and James W. Holleman May 1978 303 p refs Sponsored by DOE and EPA
(PB-282796/2; ORNL/EIS-80; EPA-600/1-78-023) Avail: NTIS HC A14/MF A01 CSCL 06F

Scientific literature on the biological and environmental effects of chromium is reviewed. A general summary and comprehensive discussion of the following topics as related to chromium and specific chromium compounds is presented: physical and chemical properties; occurrence; synthesis and use; analytical methodology; biological aspects in microorganisms, plants, wild and domestic animals, and humans; distribution mobility and presistence in the environment; and assessment of present and potential health and environmental hazards. Standards and governmental regulations are reviewed. More than 500 references are cited. GRA

N79-10601# National Technical Information Service, Springfield, Va.
NOISE POLLUTION ECONOMICS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978
Diane M. Cavagnaro Aug. 1978 112 p Supersedes NTIS/PS-77/0789; NTIS/PS-76/0662; NTIS/PS-75/534; NTIS/PS-74/093
(NTIS/PS-78/0851/2; NTIS/PS-77/0789; NTIS/PS-76/0662; NTIS/PS-75/534; NTIS/PS-74/093) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The economics of noise pollution control and management is presented for industry, urban areas, government planning, and transportation. The majority of reports cover the economic impact of controlling aircraft noise or the impact of motor vehicle noise on society. This updated bibliography contains 105 abstracts, 32 of which are new entries to the previous edition. GRA

N79-10602# Southern Research Inst., Birmingham, Ala.
TECHNICAL MANUAL: A SURVEY OF EQUIPMENT AND METHODS FOR PARTICULATE SAMPLING IN INDUSTRIAL PROCESS STREAMS Final Report, Feb. 1977 - Jan. 1978
W. B. Smith, P. R. Cavanaugh, and R. R. Wilson Mar. 1978 283 p refs
(Contract EPA-68-02-2131)
(PB-282501/6; EPA-600/7-78-043) Avail: NTIS HC A13/MF A01 CSCL 14B

Instruments and techniques that are available for measuring the concentration or size distribution of particles suspended in process streams are described. The standard, official, well

established methods are described as well as some experimental methods and prototype instruments. To the extent that the information could be found, an evaluation of the performance of each instrument is included. Instruments and procedures for measuring mass concentrations, opacity, and particle size distribution are presented. Procedures for planning and implementing tests for control device evaluation, a glossary and an extensive bibliography are included. GRA

N79-10603# Monsanto Research Corp., Dayton, Ohio.
PARTICULATE CONTROL MOBILE TEST UNITS: THIRD YEAR'S OPERATION Annual Report, Jun. 1976 - Jun. 1977
Donald L. Zanders Jun. 1978 29 p refs
(Contract EPA-68-02-1816)
(PB-283657/5; MRC-DA-783; EPA-600/7-78-098) Avail: NTIS HC A03/MF A01 CSCL 13B

The operation of EPA-owned mobile test units is summarized. Three field units (the baghouse, wet scrubber, and electrostatic precipitator) were designed to be used for studying the applicability of different methods for controlling fine particulate emitted from a wide variety of sources. The fourth unit (an energy van) was designed to demonstrate the feasibility of unconventional energy supply systems to support residential and commercial buildings. GRA

N79-10604# Industrial Environmental Research Lab., Cincinnati, Ohio.
POLLUTION CONTROL GUIDANCE FOR GEOTHERMAL ENERGY DEVELOPMENT
Robert P. Hartley Jun. 1978 149 p refs
(PB-282546/1; EPA-600/7-78-101) Avail: NTIS HC A07/MF A01 CSCL 13B

The EPA regulatory approach toward geothermal energy development is summarized. The state of knowledge is described with respect to the constituents of geothermal effluents and emissions, including water, air, solid wastes, and noise. Pollutant effects are discussed. Pollution control technologies that may be applicable are described along with preliminary cost estimates for their application. Finally, discharge and emission limitations are suggested that may serve as interim guidance for pollution control during early geothermal development. GRA

N79-10605# Environmental Sciences Research Lab., Research Triangle Park, N.C.
A MICROCOMPUTER-MODIFIED PARTICLE SIZE SPECTROMETER. DESCRIPTION AND PROGRAM LISTINGS Progress Report, Sep. 1976 - Dec. 1977
Charles W. Lewis May 1978 71 p refs
(PB-283678/1; EPA-600/2-78-099) Avail: NTIS HC A04/MF A01 CSCL 14B

A fully automated aerosol particle size spectrometer system is described that consists of a light scattering particle sensor, an analog to digital converter, and a microcomputer with associated printout device. The system is capable of acquiring a differetnial particle size distribution, printing hte resulting spectrum in one of three representations, and repeating the procedure at preselected intervals. An example of the application of the system for measuring an outdoor aerosol size distribution is presented. The appendices contain documented microcomputer program listings and flow charts for Program Sizer (the program that operates the spectrometer system and the principal result of this study) and Program MCA (a program that converts part of the spectrometer system to a conventional 256 channel pulse height analyzer). GRA

N79-10606# Environmental Monitoring and Support Lab., Research Triangle Park, N. C.
SURVEY OF TRANSMISSOMETERS USED IN CONDUCTING VISIBLE EMISSIONS TRAINING COURSES Final Report
Michael C. Osborne and M. Rodney Midgett Mar. 1978 49 p refs
(PB-283643/5; EPA-600/4-78-023) Avail: NTIS HC A03/MF A01 CSCL 14B

Criteria used in the evaluation were the design and performance specifications for smoke meters promulgated in the November 12, 1974, Federal Register. Sixteen smoke schools participated in the survey. Results show that only half of the transmissometers evaluated meet all of the design and performance specifications. A lack of operator understanding and familiarity with smoke generators was a contributing factor among those units that failed to meet the requirements. A list of recommendations are included for a five-phase special study that would attempt to improve the training program for smoke inspectors. GRA

N79-10607# Engineering-Science, Inc., McLean, Va.
INSPECTION OF AEROS DATA TO DEVELOP SYSTEM ENHANCEMENTS Final Report
Dec. 1977 118 p
(Contract EPA-68-02-1894)
(PB-282788/9; EPA-450/3-77-052) Avail: NTIS HC A06/MF A01 CSCL 13B

Data from national emissions data system and the storage and retrieval of aerometric data system are reviewed. Proposed source classification codes (SCCs) are also reviewed, and recommendations made to the national air data branch for the adoption of new SCCs are presented. The data records coded with ten non-specific SCCs which end in -99 are reviewed to identify more specific SCC. Verification criteria which can be used to identify anomalous emissions data were tested. A proposed index to quantify the quality of data in an emission inventory is evaluated. GRA

N79-10608# Environmental Protection Agency, Annapolis, Md. Annapolis Field Office.
A WATER QUALITY MODELLING STUDY OF THE DELAWARE ESTUARY Final Report
Leo J. Clark, Robert B. Ambrose, Jr., and Rachel C. Crain Jan. 1978 309 p refs
(PB-282984/4; TR-62) Avail: NTIS HC A14/MF A01 CSCL 13B

Data acquisition, analysis, and mathematical modelling studies were undertaken to improve the understanding of water quality interactions, particularly as they impact DO, in the Delaware Estuary. The major processes treated in this study were the advection and dispersion of salinity and dye tracers, nitrification, carbonaceous oxidation, sediment oxygen demand, reaeration, algal photosynthesis and respiration, and denitrification. The major product of this study is a calibrated and verified 'real time' hydraulic and water quality model of the Delaware Estuary between Trenton and Liston Point. GRA

N79-10609# General Accounting Office, Washington, D. C. Community and Economic Development Div.
WASTE DISPOSAL PRACTICES: A THREAT TO HEALTH AND THE NATION'S WATER SUPPLY
16 Jun. 1978 43 p
(PB-283065/1; CED-78-120) Avail: NTIS HC A03/MF A01 CSCL 13B

Practices for disposing of waste on the land have contaminated groundwater resources (water below the surface of the earth) in some heavily populated areas. The actions of the Environmental Protection Agency to alleviate the danger to public health and the environment from municipal waste disposal, and to encourage environmentally sound waste disposal practices are reviewed. GRA

N79-10610# Energy and Environmental Research Corp., Santa Ana, Calif.
LOW NOx COMBUSTION CONCEPTS FOR ADVANCED POWER GENERATION SYSTEMS FIRING LOW-BTU GAS Final Report, Jun. 1973 - Mar. 1977
T. J. Tyson, M. P. Heap, C. J. Kau, B. A. Folsom, and N. D. Brown (Combustion Engineering, Inc., Windsor, Conn.) Nov. 1977 37 p refs
(Contract EPA-68-02-1361)
(PB-282983/6; EPA-600/2-77-235) Avail: NTIS HC A03/MF A01 CSCL 13B

Several advanced power generating concepts were analyzed. A combined gas-turbine/steam-cycle power plant with integrated gasifier was the most promising from fuel utilization and economic viewpoints. Two representative combined cycle systems were chosen for detailed NOx emission and analysis: an advanced-technology high-temperature gas turbine with a waste heat boiler, and a supercharged boiler with a current-technology gas

turbine. NOx emissions were investigated using a kinetic model, which was validated by comparison with best available experimental data and then applied to idealized combustor configurations. Calculations indicate that staged combustion involving rich primary zones and controlled mixing secondary zones minimizes thermal NOx and NOx produced from ammonia in the fuel gas. Minimum calculated NOx levels were: 150 ppm for the high temperature turbine, with a 0.45 equivalence ratio and 4000 ppm of fuel ammonia; and 125 ppm for the supercharged boiler, with 5% excess air and 500 ppm of fuel ammonia. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N79-10611 California Inst. of Tech., Pasadena.
SEISMOLOGICAL STUDY OF THE NINETYEAST AND CHAGOS-LACCADIVE RIDGES, INDIAN OCEAN, PART 1. MODELS FOR ASYMMETRIC AND OBLIQUE SPREADING AT MIOCEAN RIDGES, PART 2. ATTENUATION STUDIES USING SPLIT NORMAL MODES Ph.D. Thesis
Seth Avram Stein 1978 215 p
Avail: Univ. Microfilms Order No. 7816957

The Ninetyeast and Chagos-Laccadive Ridges in the Indian Ocean, in the interior of the oceanic plate, both show unusual seismicity. The mechanisms of these earthquakes were studied using body and surface waves. This analysis shows that the Ninetyeast Ridge is still an active zone of deformation within the plate, along which substantial relative motion is taking place. The Chagos-Laccadive Ridge, though far less active, shows unusual seismicity in its southern portion. It is proposed that asymmetric seafloor spreading occurs as a consequence of the relative motion between ridges and slow moving mantle material below. A mechanical model of asymmetric spreading predicts that the trailing flank of a ridge migrating with respect to the mantle spreads fastest. The rotationally and elliptically split normal modes of the earth are observed for the 1960 Chilean and the 1964 Alaskan earthquakes by analysis in the time domain. Dissert. Abstr.

N79-10612 California Inst. of Tech., Pasadena.
REGIONAL VARIATIONS IN UPPER MANTLE COMPRESSIONAL VELOCITIES BENEATH SOUTHERN CALIFORNIA, PART 1. POST-SHOCK TEMPERATURES: THEIR EXPERIMENTAL DETERMINATION, CALCULATION, AND IMPLICATIONS Ph.D. Thesis
Susan Ann Raikes 1978 314 p
Avail: Univ. Microfilms Order No. 7815966

The compressional velocity within the upper mantle beneath Southern California is investigated through observations of the dependence of teleseismic P-delays at all stations of the array on the distance and azimuth to the event. The variation of residuals with azimuth was found to be as large as 1.3 sec at a single station; the delays were stable as a function of time, and no evidence was found for temporal velocity variations related to seismic activity in the area. These delays were used in the construction of models for the upper mantle P-velocity structure. A description is given of the development of a technique for the experimental determination of post-shock temperatures, and its application to several metals and silicates shocked to pressures in the range 5 to 30 GPa. The implications of these observations for the interpretation of shock-induced metamorphism and impact phenomena, and for the application of shock-wave data to the interpretation of the behaviour of silicates within the earth's mantle, are discussed. Dissert. Abstr.

N79-10613 Saint Louis Univ., Mo.
STUDY ON THE EARTH CONSTANTS IN THE CENTRAL NORTH AMERICAN CONTINENT Ph.D. Thesis
Shiang-ho Cheng 1977 233 p
Avail: Univ. Microfilms Order No. 7814542

Tidal strain was observed at Flat River, Missouri by an array of 3 component quartz-rod extensometers. In terms of five modes of data analysis, the results obtained are that the observed Love numbers are frequency-dependent and should be regarded as apparent numbers of local meaning, and that anomalous phase shifts found in the analysis are such that they can hardly be removed by applying the ocean tide loading corrections. An attempt to remove the phase shift in observations was made by studying causes other than the ocean tide loading disturbances, such as the ellipticity of the earth, the cavity effect in the tunnel, and the tilting of the ground rock near the observatory. It was found that while all the other causes are minor, the tilt of the local ground surface, which is equivalent to a topographic correction, plays an important role in distorting the tidal strain field. This suggests a reason for the diversity in the values of the Love numbers as observed around the world. Dissert. Abstr.

N79-10614 Catholic Univ. of America, Washington, D. C.
A NEAR DISTANCE GAMMA DOSE MODEL FOR FINITE RADIOACTIVE CLOUDS OF VARYING CONCENTRATION Ph.D. Thesis
John Maurice Arras 1978 167 p
Avail: Univ. Microfilms Order No. 7816859

Three sets of operations are required in applying the model. The radioactive cloud is first replaced by a geometrically equivalent group of smaller cloud volumes, each of which is treated as a source element. Each source element is then assigned an exposure rate value, obtained from data sets provided. Finally, the basic exposure rate data are multiplied by appropriate scaling and correction factors. The model was compared with several published models and with a computer code developed from basic cloud gamma dose equations. Agreement with published models is generally within thirty percent, provided that identical input parameter values can be assumed. Dissert. Abstr.

N79-10615 Rice Univ., Houston, Tex.
GRAVITY ANOMALIES, CRUSTAL STRUCTURE AND HEAT FLOW Ph.D. Thesis
Robert Carl Wegner 1978 85 p
Avail: Univ. Microfilms Order No. 7814815

A model of the crust and upper mantle is constructed to investigate the relationship between topographic elevation, density of the crust and mantle, and the observed gravity field. The behavior of the model is compared to the observed behavior of the crust based on statistical correlations between Bouguer gravity anomalies and the crustal parameters measured in the United States. The observed variations in topographic elevation, crustal thickness and average crustal density agree with the behavior of a model showing the crust is buoyantly supported by the mantle. To a lesser extent, the observed gravity anomalies also vary in response to changes in crustal thickness and upper mantle density. Dissert. Abstr.

N79-10616 Houston Univ., Tex.
IMPROVED MATHEMATICAL TECHNIQUES FOR SOLUTION OF ATMOSPHERIC DISPERSION MODELS Ph.D. Thesis
Miguel Tomas Fleischer 1978 140 p
Avail: Univ. Microfilms Order No. 7816214

Turbulent atmospheric diffusion from single ground level or elevated line or point sources was simulated using the K-theory and the resulting equations solved by spline orthogonal collocation. The physical and chemical behavior of pollutant species in the atmosphere was described by the three dimensional diffusion equation. The plume was represented by moving boundary conditions in the lateral and vertical directions. Orthogonal collocation was used to reduce the partial differential equation governing the mean concentration of contaminants to first-order ordinary differential equations. This system of equations was solved in a digital computer. An eigenvalue technique and a fourth-order Runge-Kutta method was used to solve the two and three dimensional models, respectively. Dissert. Abstr.

N79-10617 Washington Univ., Seattle.
A SIMULATION OF THE CHEMISTRY AND EMISSIONS OF EXCITED NO(+) IN AURORAS Ph.D. Thesis
Eugene Raymond Young 1978 296 p
Avail: Univ. Microfilms Order No. 7814513

The following accomplishments are reported: (1) the

development of an analytical time and altitude dependent model for the densities of major auroral species, (2) the assembly and evaluation of a comprehensive set of chemical equations for excited NO(+), (3) the development of a calculation of probably charge exchange cross section, and (4) an evaluation of the vibration-rotational structure, intensity, and observability of the optical transitions of auroral excited NO(+). The analytic simulation of the altitude dependence of low energy electron excitation is keyed to a single measurement or a small energy step computation and relieves the investigator of tedious recalculation of relative excitations at each altitude. Dissert. Abstr.

N79-10618 Washington Univ., Seattle.
POSSIBLE BAROTROPIC INSTABILITY IN THE UPPER STRATOSPHERE Ph.D. Thesis
Leonard Pfister 1977 252 p
Avail: Univ. Microfilms Order No. 7814481

To gain some understanding of three-dimensional, quasi-geostrophic barotropic instability with a view toward stratospheric applications, a numerical method for tropospheric baroclinic instability was employed to establish the structures, phase speeds, and growth rates of the normal modes of a number of idealized, barotropically unstable mean zonal wind fields. For physical clarity, the fields were kept as simple as possible, beginning with a horizontally and vertically symmetric westerly sq sech jet in a Boussinesq, adiabatic atmosphere, and progressively including complicating effects such as finite scale height, vertically variable static stability, thermal damping, and finally vertical and horizontal asymmetries in the mean zonal wind. In all cases, the vertical mean flow scale was large compared to the vertical penetration depth (as defined by the horizontal mean flow scale), which precluded baroclinic instability. Dissert. Abstr.

N79-10619 Rice Univ., Houston, Tex.
AN ANALYSIS OF THE ULTRAVIOLET LIGHT REFLECTED FROM VENUS Ph.D. Thesis
John Patrick Lestrade 1978 62 p
Avail: Univ. Microfilms Order No. 7814776

The emergent intensity from the cloud tops of Venus were measured by the Venera 9 orbiter along five paths on the illuminated disc. These radiance distributions at 3500A contain information on the vertical and horizontal structure of the clouds and explicitly show the effects of the small and large scale ultraviolet markings. Model calculations with a Mie phase function for sulfuric acid aerosols indicate that the clouds have a layered structure. The best agreement is obtained with a conservative scattering top layer of optical thickness 2, and a lower layer composed of a mixture of H2SO4 and large approximately (10 microns) absorbing particles. Dissert. Abstr.

N79-10620 Oklahoma Univ., Norman.
ANALYSIS OF ENSEMBLE AVERAGED CONCENTRATIONS AND FLUXES IN A TRACER PUFF Ph.D. Thesis
Main Rowland Hutcheson 1977 138 p
Avail: Univ. Microfilms Order No. 7815364

Tracer concentrations and fluxes in a diffusing puff released from an instantaneous ground level point source are analyzed. Three basic steps are performed. First, an estimate of the ensemble average tracer fluxes is developed. Second, an estimate of the ensemble average tracer concentration is obtained. Then the estimates are used to determine concentrations and fluxes which satisfy the diffusion equation and are as close to the estimates as possible. A concentration model is developed to provide data at grid points where there are no observations. A model to estimate the ensemble average concentration is also developed. Dissert. Abstr.

N79-10621 New Mexico State Univ., University Park.
INFRARED MEASUREMENTS OF ATMOSPHERIC AEROSOL EXTINCTION COEFFICIENTS USING A WHITE CELL Ph.D. Thesis
Bruce Allyn Blevins 1978 149 p
Avail: Univ. Microfilms Order No. 7811927

The extinction coefficients (the ratio of the effective cross section and the geometrical cross section) of three clay minerals, which are representative components of atmospheric dust aerosols, were measured as functions of wavelength in the infrared portion of the electromagnetic spectrum. The problems of particle-sizing instrument calibration for concentration and instrumentation design for a multipath white cell system are discussed. An aerosol dispersion and suspension system that presents a uniform aerosol to a folded-path infrared and visible optical system is also described. Dissert. Abstr.

N79-10622 Engineering Sciences Data Unit, London (England).
HEIGHT RELATIONSHIPS FOR NON-STANDARD ATMOSPHERES
Jun. 1978 11 p
(ESDU-78012; ISBN-0-85679-213-6) For information on availability of series, sub-series, or individual data items, write NTIS, Attn. ESDU, Springfield, Va. 22161. HC $194.50

Methods are given for calculating properties of the atmosphere in situations where ambient temperature varies with height in ways that differ from the International Standard Atmosphere and its associated off-standard atmospheres. Emphasis is given to relationships between geopotential and pressure heights in non-standard atmospheres. A typical application is to relate pressure and geopotential heights during the calculation of climb performance of an aircraft in a non-standard atmosphere. The range of applicability includes any atmospheric conditions which can be adequately represented by a model consisting of a number of layers within which temperature varies linearly with either geopotential height or pressure height, or is constant. ESDU

N79-10623 Princeton Univ., N. J.
TWO STUDIES OF LONG PERIOD BODY WAVES: UPPER MANTLE REFLECTED AND CONVERTED PHASES. RINGING P WAVES AND SUBMARINE FAULTING Ph.D. Thesis
Steven Neal Ward 1978 121 p
Avail: Univ. Microfilms Order No. 7818361

Record sections of long period seismograms from shallow focus events at distances between 80 and 120 degrees commonly display significant amounts of spatially coherent energy between the arrivals of P and PP. The majority of these coherent arrivals have ray parameters and amplitude attenuation rates closely comparable to the P phase. It was found that much of this coherent energy was derived from interactions (reflections and conversion) of elastic waves at strong velocity gradients in the upper mantle. Long period teleseismic records from shallow focus oceanic events sometimes exhibit ringing P waves. The ringing portion of these prolonged wavegroups characteristically has a narrow band frequency content, an amplitude which monotonically decreases from values comparable to the primary P pulse, and a high station to station coherence. These traits are derived through the excitation of leaking compressional modes of the oceanic waveguide. Dissert. Abstr.

N79-10624*# National Aeronautics and Space Administration, Washington, D. C.
A ONE-DIMENSIONAL MODEL AND ITS APPLICATION TO THE STUDY OF THE DIURNAL CYCLE
J. F. Geleyn Aug. 1976 38 p refs Transl. into ENGLISH from La Meteorol. (France), Sep. 1975 p 17-33 Original language document was announced as A76-13135 Transl. by Transemantics, Inc., Washington, D. C.
(Contract NASw-2792)
(NASA-TT-F-17113) Avail: NTIS HC A03/MF A01 CSCL 04A

A one-dimensional atmospheric model is proposed, working solely in the vertical coordinate, that permits taking into account certain irreversible small-scale phenomena (radiation, water cycle, turbulence, nebulosity, etc.) and which can be later matched with large-scale, three dimensional dynamic models. Some preliminary results on a seven-week was studied in particular, are discussed. Different parameters and their combinations can be tested individually. Author

N79-10625*# National Aeronautics and Space Administration, Washington, D. C.
RADIOMETER AT A FREQUENCY OF 108-120 GHz FOR STUDY OF THE EARTH'S ATMOSPHERE
G. S. Bordonskiy Oct. 1978 30 p refs Transl. into ENGLISH of "Radiometr na Chastoty 108-120 GGts dlya Issledovaniy Atmosfery Zemli", Rept. PR-281 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1976 p 1-28 Transl. by Kanner (Leo)

Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75562; PR-281) Avail: NTIS HC A03/MF A01 CSCL 04A

Calculated and experimental design and operating characteristics of a 108-120 GHz superheterodyne radiometer with intermediate frequency modulation and a second harmonic frequency converter are presented and discussed. With a 1 sec time constant, the radiometer fluctuation sensitivity threshold is 1 K, without degradation in 2 hours of operation. Graphs of frequency variations, calibration, conversion loss, rectified current, fixed bias voltage, and contact needle impedance are included.
S.B.S.

N79-10626# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INTERNATIONAL COOPERATION AND THE DEVELOPMENT OF THE GEOMAGNETISM STUDIES IN BRAZIL
Jose Marques DaCosta Aug. 1977 24 p refs
(INPE-1103-PE/077) Avail: NTIS HC A02/MF A01

Recent international collaborative programs did not show evidence of a rapid and solid development of geomagnetic studies in Brazil. A suggestion is presented on how international cooperation could help to implement effective local and regional geomagnetism programs in Brazil. Long range international collaborative programs are also suggested. The potential benefits to education, prospecting of mineral resources, and the effective efforts made lately by the Brazilian government for the scientific and technological development of the country were emphasized.
J.A.M.

N79-10627# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ATMOSPHERIC GAMMA-RAYS AT HIGH RIGIDITY REGION
N. A. Buivan, K. R. Rao, and I. M. Martin Oct. 1978 15 p refs
(INPE-1367-PE/172) Avail: NTIS HC A02/MF A01

The differential atmospheric gamma ray spectra were obtained between 0.2 and 17 MeV with omnidirectional detectors from stratospheric balloon flights carried up to 4 g/sq cm from Sao Jose dos Campos, Brazil and compared with high energy spectra. The observed flux at different energies and at different atmospheric depths above 100 g/sq cm was found to be compatible with theoretical predictions. The comparison of observations with theory allowed the atmospheric component contribution to be predicted in the astronomical gamma ray observations.
J.A.M.

N79-10628# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
F-REGION NEUTRAL WINDS FROM IONOSONDE MEASUREMENTS OF h SUB mF2 AT LOW LATITUDE MAGNETIC CONJUGATE REGIONS
J. A. Bittencourt Aug. 1977 22 p refs
(INPE-1098-PE/074) Avail: NTIS HC A02/MF A01

The behavior of the F2-peak height difference delta h sub F2, between low latitude magnetic conjugate points, is known to be governed by thermospheric winds blowing along the magnetic meridian. Ground based ionosonde measurement of h sub m F2, at two pairs of magnetic conjugate stations, were analyzed in conjunction with the results of a realistic dynamic computer model of the tropical ionospheric F-region, to determine thermospheric wind velocities. The behavior of monthly average values of the sun, at conjugate points, of the thermospheric horizontal wind velocity component in the magnetic meridian, at low latitudes, is inferred for months of solstice and equinox, as well as for periods of low and high solar activity.
J.M.S.

N79-10629# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EFFECTS OF ATMOSPHERE, TEMPERATURE AND EMITTANCE ON REFLECTED AND EMITTED ENERGY
Ravindra Kumar Oct. 1977 18 p refs
(INPE-1130-PE/094) Avail: NTIS HC A02/MF A01

From the calculation of energy reflected and emitted from a target including atmospheric effects, using the LOWTRAN 3 program for the Midlatitude Summer model, the following conclusions were obtained: At 3.5 microns, q (the energy emitted by a natural target/energy reflected from it) is much less than 1 except at high temperatures and for high emittance. (2) At 4 microns, q is of the order of magnitude equal to 1 for most targets. (3) At 4.6 microns, q is much larger than 1 at high temperature and high emittance. Previously acquired field spectroradiometric data on soils in the 4 to 14 micron range were found to agree closely with theoretical calculations of reflected and emitted energy.
J.A.M.

N79-10630# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TRUE HEIGHT CALCULATION FROM IONOGRAMS
R. P. Kane Sep. 1978 6 p refs
(INPE-1360-PE/168) Avail: NTIS HC A02/MF A01

A least squares fit model using ionospheric electron density profiles with continuous gradients and underlying ionization correction is examined. Data-preparation error, transient inconsistency of the ordinary and extraordinary echoes, and an indeterminate equation system are analyzed as model irregularities. Three restraints for the least squares fit method of height calculation are presented.
S.B.S.

N79-10631# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GAMMA-RAY LINES OBSERVED IN BALLOON FLIGHTS AT HIGH RIGIDITY
N. A. Buivan, K. R. Rao, and I. M. Martin Oct. 1978 17 p refs
(INPE-1366-PE/171) Avail: NTIS HC A02/MF A01

Gamma ray lines at 0.511 Mev and 1.632 Mev were observed at high rigidity (12.5 GV) during stratospheric balloon flights carried out, up to 4 g/sq cm, from Sao Jose dos Campos, Brasil. The flux of these lines are compared with the results obtained at other rigidity regions. The intensity variation of the most prominent of these lines, the annihilation line at 0.511 Mev, is found to be compatible, at various atmospheric depths, with theoretical predictions. The study leads to the estimation of an upper limit for the flux of the extra terrestrial 0.5111 Mev gamma ray line.
G.Y.

N79-10632# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ION PRODUCTION RATES DUE TO PARTICLE PRECIPITATION IN THE LOWER IONOSPHERE, OVER THE SOUTH ATLANTIC ANOMALY, FROM ROCKET ION COMPOSITION RESULTS DURING A TOTAL SOLAR ECLIPSE
M. A. Abdu, Inez S. Batista, and Jose H. A. Sobral Oct. 1978 29 p refs
(INPE-1369-PE/173) Avail: NTIS HC A03/MF A01

Rocket results of ion densities during the 12 November 1966 total solar eclipse are analysed using detailed ion chemistry models for the D and E regions. Steady state continuity equation for the ionic species are solved to derive the ion production rates that can best explain the full sun ion composition results. The ion production rates so derived are inserted in a set of time dependent solutions of the continuity equation to predict the ion density distribution during the totality of the eclipse. By comparing calculated and observed ion densities during the totality the residual ion production rates were determined, from which the part that can not be accounted for by solar radiation is attributed to the precipitation of high energy particles in the South Atlantic geomagnetic anomaly.
G.Y.

N79-10633# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
BEHAVIOR OF THE (OI) 6300 A EMISSION AT THE MAGNETIC EQUATOR AND ITS RELATION TO THE VERTICAL E x B PLASMA DRIFT VELOCITY
J. A. Bittencourt and Y. Sahai Aug. 1978 17 p refs
(INPE-1346-PE/163) Avail: NTIS HC A02/MF A01

Observations of the local time dependence of the (OI) 6300 A zenith intensity, made with a filter photometer near the magnetic equator, are presented, together with the local time behavior of theoretical 6300 A intensities calculated using a realistic, dynamic, computer model of the tropical ionosphere. It is shown that the observed local time variation of the 6300 A emission is controlled by the local time behavior of the vertical

E x B plasma drift velocity, at the magnetic equator. The typical 6300 A enhancement, that occurs near midnight, gives an indication of the magnitude, and time of reversal, of the vertical plasma drift velocity. Author

N79-10634*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MAN'S IMPACT ON THE TROPOSPHERE: LECTURES IN TROPOSPHERIC CHEMISTRY
Joel S. Levine, ed. and David R. Schryer, ed. Sep. 1978 371 p refs Lectures held at Hampton, Va., 1977
(NASA-RP-1022; L-12142) Avail: NTIS HC A16/MF A01 CSCL 04A

Lectures covering a broad spectrum of current research in tropospheric chemistry with particular emphasis on the interaction of measurements, modeling, and understanding of fundamental processes are presented. For individual titles, see N79-10635 through N79-10644.

N79-10635*# Statewide Air Pollution Research Center, Riverside, Calif.
MECHANISMS, MODELS, AND MYTHS: FICTION AND FACT IN TROPOSPHERIC CHEMISTRY
James N. Pitts, Jr. *In* NASA. Langley Res. Center Man's Impact on the Troposphere Sep. 1978 p 1-25 refs (For primary document see N79-10634 01-46)
(Grants NSF ENV-73-02904-A04; EPA-804546-02)
Avail: NTIS HC A16/MF A01 CSCL 04A

Various aspects of the dangers inherent in being overconfident about the reliability (especially the absolute accuracy) of the atmospheric chemistry input into current models for tropospheric air pollution were illustrated. A review is presented of the criteria that must be met before even a simple homogeneous gas phase photochemical reaction carried out under laboratory conditions can be considered proof of a mechanism. Specific examples of fiction and fact in the complex heterogeneous systems that characterize ambient polluted atmospheres are discussed. B.B.

N79-10636*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NATURAL AND PERTURBED TROPOSPHERE
Richard W. Stewart, Sultan Hameed (State Univ. of New York at Stony Brook), and Joseph Pinto (State Univ. of New York at Stony Brook) *In* NASA. Langley Res. Center Man's Impact on the Troposphere Sep. 1978 p 27-64 refs (For primary document see N79-10634 01-46)
Avail: NTIS HC A16/MF A01 CSCL 04A

The processes important in establishing the concentrations of a number of tropospheric species were reviewed, and gaps in current understanding of these processes. The points at which man may intervene in the major cycles of atmospheric gases were identified and the possible consequences of such interventions are described. Pollutants released into the troposphere may adversely affect the environment by virtue of their chemical interactions with other atmospheric species, their radiative properties, or both. Problems discussed include the growth of atmospheric carbon dioxide (CO2) resulting from the burning of fossil fuels and its possible climatic effects, the consequences of increased levels of carbon monoxide (CO) emission on the self-cleaning ability of the troposphere and on the radiation budget, and possible changes in the stratospheric odd nitrogen and ozone amounts due to increased use of fertilizers in agriculture. The magnitude of the perturbations predicted by various model studies were reviewed with particular attention to uncertainties which may affect the results. B.B.

N79-10637*# National Center for Atmospheric Research, Boulder, Colo.
POSSIBLE NONURBAN ENVIRONMENTAL EFFECTS DUE TO CARBON MONOXIDE AND NITROGEN OXIDES EMISSIONS
Shaw C. Liu (Michigan Univ., Ann Arbor) *In* NASA. Langley Res. Center Man's Impact on the Troposphere Sep. 1978 p 65-79 refs Sponsored by NSF (For primary document see N79-10634 01-46)
Avail: NTIS HC A16/MF A01 CSCL 04A

Environmental effects were investigated and reviewed. The sources and sinks of NOx and its concentrations in the troposphere are discussed in detail. A brief discussion of the sources and sinks of CO was given. B.B.

N79-10638*# Florida Univ., Gainesville.
THE EFFECTS OF INCREASED CO AND NO(X) UPON TROPOSPHERIC OH, CH4, AND RELATED SPECIES
W. L. Chameides *In* NASA. Langley Res. Center Man's Impact on the Troposphere Sep. 1978 p 81-108 refs (For primary document see N79-10634 01-46)
Avail: NTIS HC A16/MF A01 CSCL 04A

The tropospheric OH density was shown to be sensitive to the atmospheric abundance of CO and NOx (NO + NO2). The anthropogenic production of CO and NOx is significant when compared with natural sources of these compounds, and thus the abundances of CO and NOx may increase in the coming decades if present trends continue. Model calculations are presented to indicate the possible magnitude of perturbations in OH and related compounds such as CH4, due to increased CO and NOx emissions. B.B.

N79-10639*# State Univ. of New York at Albany.
THE TRANSPORT CYCLE OF ATMOSPHERIC OZONE AND ITS MEASUREMENTS FROM AIRCRAFT AND AT THE EARTH'S SURFACE
Phillip D. Falconer, Robert Pratt, and Volker A. Mohnen *In* NASA. Langley Res. Center Man's Impact on the Troposphere Sep. 1978 p 109-147 refs (For primary document see N79-10634 01-46)
Avail: NTIS HC A16/MF A01 CSCL 04A

The fundamental aspects of the ozone cycle, for which there appears to be solid observational documentation are summarized as follows: (1) photochemical production within the equatorial stratosphere; (2) poleward flux of ozone through the general circulation patterns of the stratosphere; (3) intrusion of ozone into the troposphere through various transport and mixing processes; (4) ozone mixing within the troposphere; and (5) ozone destruction within the planetary boundary layer or at the earth's surface. These mechanisms were illustrated in a tentative model for large scale ozone fluxes. It was clear that both atmospheric dynamics and photochemistry play important roles in the distribution of ozone in the atmosphere. B.B.

N79-10640*# Bell Telephone Labs., Inc., Murray Hill, N. J.
URBAN PRECURSORS AND THEIR PHOTOCHEMICAL PRODUCTS
T. E. Graedel *In* NASA. Langley Res. Center Man's Impact on the Troposphere Sep. 1978 p 149-201 refs (For primary document see N79-10634 01-46)
Avail: NTIS HC A16/MF A01 CSCL 04A

Many aspects of the photochemical processes in the troposphere near and within urban areas have recently been explored by kinetic computer modeling. Comparison with the results of data analyses indicates that features of and patterns in air quality data can be semiquantitatively reproduced for a variety of geographical and chemical situations. Results are presented for calculations representing urban workdays, urban Sundays, transport and chemistry upwind of, within, and downwind of urban areas, and overwater transport. The effects of incomplete or insufficiently accurate information on the results of photochemical calculations are described. A current limitation in the detailed validation of these theoretical chemical studies is a sparseness of data on reactive free radicals, on inorganic photochemical products, on organic reactants and products, and on certain of the applicable meteorological processes. Appropriate chemical and meteorological measurements needed to alleviate these interpretive limitations on the understanding of urban tropospheric processes are discussed. Author

N79-10641*# California Inst. of Tech., Pasadena.
MATHEMATICAL MODELING OF THE POLLUTED TROPOSPHERE
John H. Seinfeld *In* NASA. Langley Res. Center Man's Impact on the Troposphere Sep. 1978 p 203-253 refs (For primary document see N79-10634 01-46)
Avail: NTIS HC A16/MF A01 CSCL 04A

An overview of the general problems involved in mathematical modeling of the polluted troposphere (principally the urban atmosphere) is provided. The fundamentals of air quality models

are presented and aerosol processes in the polluted troposphere are discussed. A review of the major elements of mathematical models is included. A model capable of predicting the transformation of gaseous material to particulate material in the urban atmosphere and urban plume was developed. B.B.

N79-10642*# Environmental Research and Technology, Inc., Santa Barbara, Calif.

THE ROLE OF COMPUTER MODELING OF PHOTOCHEMICAL SMOG IN DEFINING EXISTING MEASUREMENT NEEDS

Alan C. Lloyd *In* NASA. Langley Res. Center Man's Impact on the Troposphere Sep. 1978 p 255-318 refs Sponsored in part by Coordinating Res. Council (For primary document see N79-10634 01-46)

(Grant NSF ATM-75-18521)

Avail: NTIS HC A16/MF A01 CSCL 04A

Following a brief history of photochemical smog formation and its effects in the Los Angeles Basin, the chemical mechanisms, first suggested for photochemical smog formation are discussed. This is called the prehydroxyl radical or pre-OH era. Subsequently, the current ideas on photochemical smog formation in the post-OH era are presented in depth. The various kinetic and mechanistic inputs required to formulate a chemical mechanism to simulate photochemical smog formation was addressed. The computed and measured concentration time profiles for a number of pollutants under various conditions are reviewed. The role of measurements under laboratory and real atmospheric conditions in the refinement of the chemical mechanism is summarized. B.B.

N79-10643*# Washington Univ., St. Louis, Mo. Air Pollution Research Lab.

ATMOSPHERIC SULFUR BEHAVIOR IN POWER PLANT AND REGIONAL PLUMES

Rudolf B. Husar *In* NASA. Langley Res. Center Man's Impact on the Troposphere Sep. 1978 p 319-348 refs (For primary document see N79-10634 01-46)

(Grant EPA-R-803896)

Avail: NTIS HC A16/MF A01 CSCL 04A

A key question in the current energy debate concerns the economic and environmental costs of increased coal usage as a replacement for gas and oil. The environmental constraints are due to mining, transportation, and the release of combustion products (SOx, CO2, and fly ash). Sulfur oxide emissions and their effect on the environment were under intense study during the past 25 years, first because of the acute air pollution episodes that occurred in populated areas (e.g., the 1952 and 1962 London episodes) and more recently because of the chronic effects on the ecosystem (e.g., acidification of lakes in southern Scandinavia and the Northeastern United States). The past years of monitoring and research contributed appreciably to the understanding of atmospheric sulfur behavior. The key findings are summarized. B.B.

N79-10644*# California Univ., Berkeley. Lawrence Berkeley Lab.

SOOT-CATALYZED OXIDATION OF SULFUR DIOXIDE

S. G. Chang and T. Novakov *In* NASA. Langley Res. Center Man's Impact on the Troposphere Sep. 1978 p 349-369 refs Sponsored by NSF (For primary document see N79-10634 01-46)

Avail: NTIS HC A16/MF A01 CSCL 04A

Experimental results are reviewed which demonstrate that combustion generated soot particles can oxidize SO2 in both the absence (dry mechanism) and the presence (wet mechanism) of liquid water. The wet mechanism is much more efficient than the dry one and is applicable to situations where the aerosol particles are covered with a liquid water layer. Calculations are presented which suggest that the soot catalyzed oxidation of SO2 can be the dominant mechanism under realistic atmospheric conditions. B.B.

N79-10645*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF SOLAR ACTIVITY ON THE FREQUENCY OF OCCURRENCE OF MAJOR ANOMALIES IN THE ARCTIC

M. Sh. Bolotinskaya Nov. 1978 10 p refs Transl. into ENGLISH from the book "Solnechno-Atmosfernyye Svyazi v Teorii Klimata i Prognozakh Pogody" Leningrad, Gidrometeoizdat, 1974 p 80-86 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Arctic and Antarctic Sci. Res. Inst., Leningrad

(Contract NASw-3199)

(NASA-TM-75347) Avail: NTIS HC A02/MF A01 CSCL 04A

Major air pressure and temperature anomalies in certain arctic regions were studied with a view toward predicting their occurrence. Correlations are sought between the frequency of arctic anomalies and solar activity, or specifically the Wolf number and the index of geomagnetic disturbance. Graphic techniques are used to show that solar activity has a definite influence on the fraquency of occurrence of major anomalies of pressure and temperature in the Arctic. A.R.H.

N79-10646*# National Aeronautics and Space Administration, Washington, D. C.

MICROSEISMIC STUDY OF THE INTERANDINE VALLEY BETWEEN LATACUNGA AND CUAYLLABAMBA

M. Hall and M. Ramon Nov. 1978 56 p refs Transl. into ENGLISH of "Estudio Microsismico del Valle Interandino Entre Latacunga y Guayllabamba" Facultad de Geologia Escuela Politecnica Nacional, Quito, Ecuador, Jul. 1978 p 1-29 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-75370) Avail: NTIS HC A04/MF A01 CSCL 08K

The present state of two active volcanoes and the principal active seismic faults in a 100 km area from Quito to Toacaso, Ecuador was studied. A brief seismic history of the region is reviewed. J.A.M.

N79-10647*# National Aeronautics and Space Administration, Washington, D. C.

VECTOR DIAGRAM OF THE CHEMICAL COMPOSITIONS OF TEKTITES AND EARTH LAVAS

L. G. Kvasha and G. S. Gorshkov Nov. 1978 17 p refs Transl. into ENGLISH from Meteoritika (USSR), v. 20, 1961 p 193-203 Translation was announced as N74-22031 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.

(Contract NASw-2483)

(NASA-TM-75371) Avail: NTIS HC A02/MF A01 CSCL 08G

The chemical compositions of tektites and various volcanic glasses, similar in composition to tektites are compared by a petrochemical method. The advantage of the method is that a large number of chemical analyses of igneous rocks can be graphically compared with the help of vectors, plotted in relation to six parameters. These parameters, calculated from ratios of the main oxides given by silicate analysis, reflect the chief characteristics of igneous rock. Material for the study was suppled by data from chemical analysis characterizing tektites of all known locations and data from chemical analyses of obsidians similar in chemical composition to tektites of various petrographical provinces. G.Y.

N79-10648*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A VORTEX MODEL FOR TRANSPORT IN THE POLAR STRATOSPHERE

I. J. Eberstein, F. Y. Yap (Computer Sciences Corp., Greenbelt, Md.), and V. Veirs (Colorado College, Colorado Springs) Aug. 1978 34 p refs Submitted for publication

(NASA-TM-79630) Avail: NTIS HC A03/MF A01 CSCL 04A

A semi-empirical model based on a Gaussian vorticity distribution was developed for determining eddy diffusivity and wind transport distributions in the polar stratosphere. The model uses as input data pressure surface heights measured at periods of the year when the stratospheric polar vortex exhibits nearly circular patterns around the pole. The components of the polar wind velocities that result from a Prandtl eddy viscosity distribution are found to be in general agreement with those obtained by other investigators. Author

N79-10649# Analytic Sciences Corp., Reading, Mass.

FOURIER PHYSICAL GEODESY Scientific Report, 1 May 1977 - 1 Mar. 1978

Stanley K. Jordan 1 Mar. 1978 58 p refs

(Contract F19628-77-C-0152)

(AD-A056837; TASC-TIM-868-2; AFGL-TR-78-0056) Avail: NTIS HC A04/MF A01 CSCL 08/5

Fourier transforms are efficient and convenient for analyzing local gravity data, but the accuracy of Fourier methods is restricted by the flat-earth approximation. In this paper, the theory of matched asymptotic (inner and outer) expansions is used to develop improved flat-earth approximations, determine regions of convergence, and match global (round-earth) and local (flat-earth) gravity models. Accurate solutions in the terms of Fourier transforms are given for the integrals of Poisson, Stokes, and Vening Meinesz. The new theory provides an error analysis of flat-earth algorithms and a systematic procedure for improving their accuracy. Author (GRA)

N79-10650# TRW Systems Group, Redondo Beach, Calif.
MONTE CARLO ION SIMULATION OF NEGATIVE ION COLLECTION BY A ROCKET-BORNE MASS SPECTROMETER Interim Report
Takashi Sugimura Mar. 1978 36 p refs
(Contract F19628-77-C-0020)
(AD-A057070; AFGL-TR-78-0094; SCIENTIFIC-1) Avail: NTIS HC A03/MF A01 CSCL 04/1

The Direct Simulation Monte Carlo Method developed for the prediction of positive ion collection by a rocket-borne probe has been extended to simulate negative ion effects. Major program modifications were necessary to properly describe the electron motion. In order to verify that the charged particle interactions were computed correctly a series of numerical experiments were performed. The results of these calculations indicate that both the electron and ion mobilities are simulated properly in the presence of an applied electric field. Author (GRA)

N79-10651# Utah Univ., Salt Lake City. Dept. of Meteorology.
THEORIES OF ATMOSPHERIC TRANSPORT AND DIFFUSION
S. K. Kao Jan. 1978 141 p refs
(Contract EY-76-S-02-2455)
(COO-2455-17) Avail: NTIS HC A07/MF A01

Atmospheric transport and diffusion in the planetary boundary layer is discussed. Basic tools for analyzing turbulent motion and diffusion are described and basic theories of transport and diffusion of pollutants in the Eulerian and Lagrangian systems are presented. DOE

N79-10652# California Univ., Livermore. Lawrence Livermore Lab.
SOME OBSERVATIONS OF SUSPENSION OF DUST BY WIND FROM DRY LAKES
D. N. Homan Apr. 1978 21 p refs
(Contract W-7405-eng-48)
(UCID-17813) Avail: NTIS HC A02/MF A01

Particle concentrations of dust in air were measured as a function of wind at two dry lakes at the Nevada Test Site (NTIS) during the spring and summer of 1975. Particle concentrations varied widely for both windy and calm conditions with substantial overlap in the data for the two conditions. The average particle concentration during the transition from calm to windy conditions was found in some cases to decrease as the wind increased; particle concentrations during windy conditions were typically characterized by short bursts, decreasing in frequency and intensity as the wind continues. Gust fronts, the rapid onset of stronger gusty winds, caused the greatest bursts of dust suspension. DOE

N79-10653# Argonne National Lab., Ill.
THREE-DIMENSIONAL, SECOND-ORDER CLOSURE NUMERICAL MODEL OF MESOSCALE CIRCULATIONS IN THE LOWER ATMOSPHERE: DESCRIPTION OF THE BASIC MODEL AND AN APPLICATION TO THE SIMULATION OF THE ENVIRONMENTAL EFFECTS OF A LARGE COOLING POND
T. Yamada Mar. 1978 92 p refs
(Contract W-31-109-eng-38)
(ANL-RER-78-1) Avail: NTIS HC A05/MF A01

A detailed description is presented of a three-dimensional, mesoscale model of circulations in the lowest few kilometers of the atmosphere, the planetary boundary layer. The model is termed a turbulence second-moment closure model since it is based on various second-moment turbulence equations involving wind velocity, temperature, water vapor, and liquid water. A simplified version of the model, in which only time-dependent, partial-differential equations for the turbulence energy balance and a master length scale is recommended. A Gaussian probability function for cloud cover statistics is used in order to model condensation processes. Thus not only are the effects of thermal and moisture stratification included but the effects of condensation are considered as well. As one example of an environmental assessment application, the model is used to simulate formation of clouds over a cooling pond, and the results obtained are qualitatively compared with an observation of this inadvertent modification of local weather. DOE

N79-10654# California Univ., Livermore. Lawrence Livermore Lab. Earth Sciences Div.
TWO-DIMENSIONAL COMPUTER SIMULATION OF HYPERVELOCITY IMPACT CRATERING: SOME PRELIMINARY RESULTS FOR METEOR CRATER, ARIZONA
J. B. Bryan, D. E. Burton, M. E. Cunningham, and L. A. Lettis, Jr. Apr. 1978 59 p refs Presented at the 9th Lunar and Planetary Sci. Conf., Houston, Tex., 13-17 Mar. 1978
(Contract W-7405-eng-48)
(UCRL-80539; Conf-780314-4) Avail: NTIS HC A04/MF A01

A computational approach used for subsurface explosion cratering was extended to hypervelocity impact cratering. Meteor (Barringer) Crater, Arizona, was selected for the first computer simulation because it was the most thoroughly studied. It is also an excellent example of a simple, bowl-shaped crater and is one of the youngest terrestrial impact craters. Shoemaker estimates that the impact occurred about 20,000 to 30,000 years ago. Initial conditions for this calculation included a meteorite impact velocity of 15 km/s, meteorite mass of 1.57E + 08 kg, with a corresponding kinetic energy of 1.88E + 16 J (4.5 megatons). A two dimensional Eulerian finite difference code called SOIL was used for this simulation of a cylindrical iron projectile impacting at normal incidence into a limestone target. For this initial calculation, a Tillotson, equation of state description for iron and limestone was used with no shear strength. A color movie based on this calculation was produced, using computer-generated graphics. DOE

N79-10655# Sandia Labs., Albuquerque, N. Mex.
GEOTHERMAL WELL TECHNOLOGY: DRILLING AND COMPLETIONS PROGRAM PLAN
M. M. Newsom, J. H. Barnett, L. E. Baker, S. G. Varnado, and J. Polito Mar. 1978 71 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1630) Avail: NTIS HC A04/MF A01

A nine-year program is outlined based upon an objective of reducing the cost of geothermal energy development and providing a major stimulus to meeting the power-on-line goals established by the Department of Energy. Major technological challenges include improvements in: geothermal drilling fluids, downhole drilling motors, rock bits, high flow rate, high temperature completion, and reinjection techniques. Fundamental studies in drilling energetics improve the understanding of drilling mechanics and lead to advanced development of high performance, low cost geothermal drilling systems. DOE

N79-10656# California Univ., Berkeley. Lawrence Berkeley Lab. Earth Sciences Div.
ASSESSMENT OF SURFACE GEOPHYSICAL METHODS IN GEOTHERMAL EXPLORATION AND RECOMMENDATIONS FOR FUTURE RESEARCH
N. E. Goldstein, R. A. Norris, and M. J. Wilt 1978 170 p refs
(Contract W-7405-eng-48)
(LBL-6815) Avail: NTIS HC A08/MF A01

The four classes of geophysical methods considered are: passive seismic methods; active seismic methods; natural field electrical and electromagnetic methods; and, controlled-source electrical and electromagnetic methods. Areas of research for improvement of the various techniques for geothermal exploration are identified. DOE

N79-10657# Stanford Research Inst., Menlo Park, Calif.
DEVELOPMENT OF A VERTICAL MIXING DATA BASE IN THE SAN FRANCISCO BAY AND DELTA REGION, VOLUME 1: MAIN REPORT Final Report
P. B. Russell Oct. 1977 44 p refs
(Contract ARB-A6-066-80)
(PB-282455/5; ARB-R-A6-066-80-77-74-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 04A

A network of 13 sodars (acoustic radars) was operated from mid-August to early November 1976. Ancillary measurements of temperature and humidity profiles, haze and cloud layering, and 10 m winds were made by airplane, lidar and anemometer. Techniques of filming and manual digitization were developed to convert the continuous sodar data to hourly digital parameters describing mixing depth and nearsurface echo type (a stability indicator). The sodar-inferred mixing depths were compared to those inferred from the ancillary measurements. These and previous tests show good overall agreement and demonstrate that sodar measurements compare very favorably with alternate techniques for determining mixing depth in the Bay Area. To illustrate the use of the data, time-dependent maps of mixing depth are derived for a two-day period. GRA

N79-10658# Stanford Research Inst., Menlo Park, Calif.
DEVELOPMENT OF A VERTICAL MIXING DATA BASE IN THE SAN FRANCISCO BAY AND DELTA REGION, VOLUME 2: DATA APPENDICES Final Report
P. B. Russell Oct. 1977 118 p 2 Vol.
(Contract ARB-A6-066-80)
(PB-282456/3; ARB-R-A6-066-80-77-75-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 04A

Data Appendices includes the digitized sodar, airplane, and wind data. The sodar and wind data are also available on computer cards. GRA

N79-10659# National Weather Service, Silver Spring, Md. Office of Meteorology and Oceanography.
PHOTOCHEMICAL (OXIDANT) AIR POLLUTION SUMMARY INFORMATION
Stephen W. Harned and Thomas Laufer Dec. 1977 19 p refs
(PB-283868/8; NOAA-TM-NWS-FCST-22; NOAA-78062202) Avail: NTIS HC A02/MF A01 CSCL 04A

Air pollution information designed to aid in the developing of techniques to forecast meteorological conditions which could produce photochemical problems is presented. These pollutants result from complex chemical reactions and their character can change with time and space. Techniques using only mixing heights, transport winds and ventilation are generally inadequate in predicting the conditions favorable for photochemical oxidant buildups. Areas investigated include: (1) the chemistry involved, (2) meteorological conditions favorable for the production of the photochemical oxidants, and (3) the unique aspects of this type of pollution. GRA

N79-10660# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
THE ISEE 1 AND 2 MEDIUM ENERGY PARTICLES EXPERIMENT
D. J. Williams, E. Keppler (Max-Planck Inst. Aeronomy, Germany), T. A. Fritz (Max-Planck Inst. Aeronomy, Germany), B. Wilken (Max-Planck Inst. Aeronomy, Germany), and G. Wibberenz (Kiel Univ., W. Germany) Apr. 1978 42 p refs
(PB-283350/7; NOAA-TM-ERL-SEL-51) Avail: NTIS HC A03/MF A01 CSCL 04A

The medium energy particles experiment (MEPE) on board ISEE 1 and 2 are described. The MEPE consists of the WIM Instrument on ISEE 1 and the KED instrument on ISEE 2. Both instruments employ solid state detectors and magnetic analysis to measure the angular, energy, and intensity distributions of protons (ions) above 24 keV and electrons above 20 keV. The WIM instrument also includes a composition measurement employing Delta E by E and time-of-flight techniques. Three parameter analysis is performed above 250 keV/nucleon, and single parameter analysis is performed above 125 keV/nucleon for helium through oxygen. Three-dimensional angular distributions are obtained through the use of a scan platform in the WIM instrument and multiple detector heads in the KED instrument. A variety of operational modes are used to optimize data collection from both instruments. Resolutions up to 128 channels in energy, 192 samples over the unit sphere in angle, and 0.095 seconds in time are available. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N79-10661 Wisconsin Univ. - Madison.
DIAGNOSTICS OF OBSERVED AND NUMERICALLY SIMULATED EXTRATROPICAL CYCLONES Ph.D. Thesis
Carlyle Hilton Wash 1978 238 p
Avail: Univ. Microfilms Order No. 7811750

Observed and numerically simulated extratropical cyclones are investigated using quasi-Lagrangian diagnostics to isolate reasons for forecast success and failure. In this initial application of transport theory to model verification, three satisfactory NMC forecasts (two LFM and one coarse mesh PE) of Midwest cyclogenesis are studied and compared with quasi-Lagrangian diagnostics of the observed cyclone. Diagnostics of mass and storm angular momentum is isentropic and isobaric coordinates are evaluated to examine intensities of observed and model circulations and to verify quantitatively model cyclone forecasts. The analyses of cases of good and poor prediction demonstrate the validity and utility of physical verification with comparative quasi-Lagrangian diagnostics. The quasi-Lagrangian statistics were capable of isolating model strengths and deficiencies and provided insight into the kinematic and dynamic structure of the forecasts. Dissert. Abstr.

N79-10662 California Univ., San Diego.
STRUCTURE OF THE MARINE SURFACE LAYER Ph.D. Thesis
Kurt Frederick Schmitt 1978 139 p
Avail: Univ. Microfilms Order No. 7814993

Several air-sea interaction phenomena were examined by analyzing micrometeorological measurements made in the marine surface layer. Measurements of turbulent wind velocity, humidity, and temperature were made over the ocean at three different locations between the heights of 8 and 29m. Open ocean data were obtained from the R/P FLIP as part of the North Pacific Experiment (NORPAX) during January and February of 1974. Temperature and humidity measurements were also made at the Scripps Pier, La Jolla, California in the spring of 1976. Additional velocity measurements were conducted during the spring 1977 West Coast Experiment near San Diego, California. To support the methods used in acquiring and reducing the marine surface layer data, overland surface layer measurements obtained by Champagne et al., (1977) using similar instrumentation and techniques are also analyzed and presented.
Dissert. Abstr.

N79-10663 Oregon State Univ., Corvallis.
INFLUENCE OF STRATIFICATION AND ACCELERATIONS ON BOUNDARY PRODUCTION OF VERTICAL MOTION Ph.D. Thesis
Soon-Ung Park 1978 100 p
Avail: Univ. Microfilms Order No. 7815690

The influence of stratification and accelerations on synoptic-scale, boundary layer production of vertical motion is examined for the case of oscillating boundary-layer flow driven by time-dependent, horizontally-periodic surface temperature perturbations. It is found that only very strong stratification can significantly reduce the boundary layer pumping through pressure adjustments within the boundary layer. As a step in understanding the complicated dynamics of the structure of accelerated stratified boundary layers, order-of-magnitude analyses of variables for each layer are examined. This structure depends on the relative magnitude of the non-dimensional forcing frequency and the product of the stratification parameter and Ekman number. Applications to both synoptic and diurnal atmospheric circulations are considered. Dissert. Abstr.

N79-10664 Rice Univ., Houston, Tex.
LIGHTNING LOCATION IN A STORM WITH STRONG WIND SHEAR Ph.D. Thesis
Donald Ray MacGorman 1978 86 p
Avail: Univ. Microfilms Order No. 7814777

Lightning flashes from a storm in northeastern Colorado were reconstructed using acoustic techniques and superimposed on radar reflectivity contours. These plots were examined for patterns in the lightning structure and in its relation to storm structure. The large-scale structure of lightning in the storm was explained by a model of charge distribution. Strong wind shear inhibits the vertical ascent of small, positively charged drops and advects them downwind from the storm cells. The effect is to modify the more common vertical distribution, with positive charge above negative, so that the distribution is fairly horizontal, with positive charge downwind from negative. The lightning structure was predominantly horizontal. Furthermore, storm structure appeared to have a strong influence on the lightning structure.
Dissert. Abstr.

N79-10665*# RCA Service Co., John F. Kennedy Space Center, Fla.
LDAR OBSERVATIONS OF A DEVELOPING THUNDERSTORM CORRELATED WITH FIELD MILL, GROUND STRIKE LOCATION, AND WEATHER RADAR DATA INCLUDING THE FIRST REPORT OF THE DESIGN AND CAPABILITIES OF A NEW, TIME-OF-ARRIVAL GROUND-STRIKE LOCATION SYSTEM (GSLS)
Horst A. Poehler 20 Sep. 1978 147 p refs
(Contract NAS10-9130)
(NASA-CR-154626; RCA-620-5002) Avail: NTIS HC A07/MF A01 CSCL 04B

An experiment designed to observe and measure a thunderstorm prior to, during, and after its development over the Kennedy Space Center was successful. Correlated measurements of airborne field strength, ground-based field strength, LDAR lightning discharge location in the clouds, weather radar percipitation echoes, plus ground strike location with the new KSC Ground Strike Location System (GSLS) were gathered, and reported. This test marks the first operational use of the GSLS System, and this report contains the first report of its design and capabilities. Author

N79-10666*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NASA'S AVE 7 EXPERIMENT: 25-MB SOUNDING DATA
J. Greg Davis (Texas A and M Univ., College Station), Henry E. Fuelberg (Saint Louis Univ., Mo.), and Robert E. Turner Oct. 1978 222 p refs
(NASA-TM-78197) Avail: NTIS HC A10/MF A01 CSCL 04B

The AVE 7 Experiment is described and tabulated rawinsonde data at 25 mb internals from the surface to 25 mb for the 24 stations participating in the experiment are presented. Soundings were taken between 0000GMT May 2 and 1200 GMT May 3, 1978. The methods of data processing and the accuracy are briefly discussed. Selected synoptic charts prepared from the data are presented as well as an example of contact data. A tabulation of adverse weather events that occured during the AVE 7 period, including freezing temperature, snow, tornadoes, damaging winds, and flooding, is presented. G.Y.

N79-10667*# National Aeronautics and Space Administration, Washington, D. C.
THE RELATIONSHIP OF AIR TEMPERATURE VARIATIONS OVER THE NORTHERN HEMISPHERE DURING THE SECULAR AND 11-YEAR SOLAR CYCLES
L. Yu. Ryzhakov and A. S. Tomskaya Nov. 1978 12 p refs Transl. into ENGLISH of the book "O Soothnoshenii Kolebaniy Temperatury Vozdukha nad Severnyn Polushariyen v Vekovom i 11-Letnem Solnechnykh Tsiklah" Leningrad, Gidrometeoizdat, 1974 p 62-69 Original language document was announced as A74-37700 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Arctic and Antarctic Scientific Inst.
(Contract NASw-3199)
(NASA-TM-75346) Avail: NTIS HC A02/MF A01 CSCL 04B

A comparison was made of air temperature anomaly maps for the months of January and July against a background of high and low secular solar activity, with and without regard for the 11 year cycle. By comparing temperature variations during the 11 year and secular cycles, it is found that the 11 year cycle influences thermal conditions more strongly than the secular cycle, and that temperature differences between extreme phases of the solar cycles are greater in January than in July. G.G.

N79-10668*# City Coll. of the City Univ. of New York.
INVESTIGATION OF MODELS FOR LARGE-SCALE METEOROLOGICAL PREDICTION EXPERIMENTS Final Technical Report
Jerome Spar 30 Nov. 1978 25 p refs
(Grant NGR-33-016-086)
(NASA-CR-157893) Avail: NTIS HC A02/MF A01 CSCL 04B

The feasibility of long-range weather prediction through the use of global general circulation models (GCMs) was investigated. A climate model was developed to simulate the monthly mean state of the atmosphere from real global initial data at the beginning of the month. The model contains the same dynamic and physical ingredients as most numerical weather prediction models and GCMs. The model generates a one-day global simulation on the 8 x 10 grid in four minutes (on an IBM 360/95 computer), so that a 30 day forecast can be executed in two hours. The high speed of the model is achieved mainly at the price of its coarse resolution, which requires certain parameterizations of surface boundary conditions, as well as inherent filtering of smaller-scale features of the initial state.
S.B.S.

N79-10669# Avco-Everett Research Lab., Everett, Mass.
INFRARED RADIATION IN A REAL TROPICAL ATMOSPHERE Final Technical Report, Aug. 1977
Lee A. Young Sep. 1977 98 p refs
(Contract F04701-75-C-0047; ARPA Order 2837)
(RADC-TR-77-288; RR-448) Avail: NTIS HC A05/MF A01

Transmission of infrared radiation in the 8-13 and 16.5-21 microns spectral regions from 3 km altitude through the atmosphere to outer space was evaluated. Analysis of tropical radiosonde atmospheric profiles of temperature and humidity shows that fluctuations in the total amount of water vapor above 3 km cause the transmission to vary by amounts from 10% to two orders of magnitude. Fluctuations in the effective temperature or pressure for absorption are shown to be small. The Curtis-Godson approximation is analyzed in detail for this problem. Also, effective parameters describing an atmospheric slant path are formulated for absorption by the water vapor continuum. Author

N79-10670*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PREDICTING TROPICAL CYCLONE INTENSITY USING SATELLITE MEASURED EQUIVALENT BLACKBODY TEMPERATURES OF CLOUD TOPS
R. Cecil Gentry, Edward Rodgers, Joseph Steranka, and William E. Shenk Sep. 1978 42 p refs Submitted for publication
(NASA-TM-79645) Avail: NTIS HC A03/MF A01 CSCL 04B

A regression technique was developed to forecast 24 hour changes of the maximum winds for weak (maximum winds less than or equal to 65 Kt) and strong (maximum winds greater than 65 Kt) tropical cyclones by utilizing satellite measured equivalent blackbody temperatures around the storm alone and together with the changes in maximum winds during the preceding 24 hours and the current maximum winds. Independent testing of these regression equations shows that the mean errors made by the equations are lower than the errors in forecasts made by the peristence techniques. Author

N79-10671*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STATISTICAL TECHNIQUE FOR DETERMINING RAINFALL OVER LAND EMPLOYING NIMBUS-6 ESMR MEASUREMENTS
Edward Rodgers, Honnappa Siddalingaiah, A. T. C. Chang, and Thomas T. Wilheit Aug. 1978 41 p refs Submitted for publication
(NASA-TM-79631) Avail: NTIS HC A03/MF A01 CSCL 04B

At 37 GHz, the frequency at which the Nimbus 6 Electrically

Scanning Microwave Radiometer (ESMR 6) measures upwelling radiance, it was shown theoretically that the atmospheric scattering and the relative independence on electromagnetic polarization of the radiances emerging from hydrometers make it possible to monitor remotely active rainfall over land. In order to verify experimentally these theoretical findings and to develop an algorithm to monitor rainfall over land, the digitized ESMR 6 measurements were examined statistically. Horizontally and vertically polarized brightness temperature pairs (TH, TV) from ESMR 6 were sampled for areas of rainfall over land as determined from the rain recording stations and the WSR 57 radar, and areas of wet and dry ground (whose thermodynamic temperatures were greater than 5 C) over the Southeastern United States. These three categories of brightness temperatures were found to be significantly different in the sense that the chances that the mean vectors of any two populations coincided were less than 1 in 100. B.B.

N79-10672*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE BENEFITS OF USING SHORT INTERVAL SATELLITE IMAGES TO DERIVE WINDS FOR TROPICAL CYCLONES
Edward Rodgers, R. Cecil Gentry (General Electric Space Div., Beltsville, Md.), William E. Shenk, and Vincent Oliver (NOAA/NESS, Camp Springs, Md.) Jul. 1978 43 p refs Submitted for publication
(NASA-TM-79594) Avail: NTIS HC A03/MF A01 CSCL 04B

During the 1975, 1976, and 1977, NOAA's National Environmental Satellite Service and NASA's Goddard Space Flight Center conducted a cooperative program to determine the optimum resolution and frequency of satellite images for deriving winds to study and forecast tropical cyclones. Rapid scan images were obtained at 7.5 minute interval from SMS-2 for hurricane Eloise and cyclone Caroline, and at 3 minute intervals from GOES-1 for tropical storms Belle, Holly, and Anita. Cloud motions were derived from these images using the Atmospheric and Oceanographic Information Processing System. Winds that were derived from the movement of upper and lower tropospheric level clouds using rapid scan data were compared with the 15 and 30 minute interval data. Greater than 10 (5) times as many clouds could be tracked to obtain winds using 3 and 7.5 minute rapid scan images as when using 15 or 30 minute interval images. A few bright areas within the central dense overcast which appeared to be moving with the winds at low levels were tracked. S.B.S.

N79-10673# Air Force Global Weather Central, Offutt AFB, Nebraska.
HIGH FREQUENCY RADIO USERS GUIDE TO AFGWC PRODUCTS
Edward D. Beard Jan. 1978 25 p refs
(AD-A057126; AFGWC-TM-78-001) Avail: NTIS HC A02/MF A01 CSCL 04/2

High Frequency (3-30 Mhz) radio waves used for long range communications networks are at the mercy of natural variations in the earths upper atmosphere, more specifically, the ionosphere. This guide explains these variations and describes various products available from the Air Force Global Weather Central (AFGWC) which can alert the system operator of observed or predicted solar and geophysical activity which can affect HF circuit reliability. The guide is basic and was designed with the field communicator in mind, but contains information of value to circuit managers and supervisors. GRA

N79-10674# Naval Environmental Prediction Research Facility, Monterey, Calif.
AN ANALYSIS OF WESTERN NORTH PACIFIC TROPICAL CYCLONE FORECAST ERRORS
Jerry D. Jarrell, Samson Brand, and Donald S. Nicklin Nov. 1977 43 p refs
(AD-A056586; NEPRF-TR-77-05) Avail: NTIS HC A03/MF A01 CSCL 04/2

Western North Pacific tropical cyclone position forecast errors for 10 years (1966-1976) are statistically analyzed. Variations of errors versus a number of parameters are examined. Discriminant analysis techniques are used to isolate categories where forecasts are likely to be above and below the median in west-east and north-south error components. The discriminant analysis was tested on 1976 data and the results are presented. It was confirmed that a small number of readily available parameters (such as location, maximum wind and components of motion) can, with reasonable effectiveness, classify a tropical cyclone forecast as representing a group with either markedly above or below average errors. The annual variations of forecast errors are also discussed and an attempt is made to explain those variations. Author (GRA)

N79-10675# Air Force Geophysics Lab., Hanscom AFB, Mass.
PERSISTENCE, RUNS, AND RECURRENCE OF VISIBILITY
Iver A. Lund and Donald D. Grantham 31 Jan. 1978 47 p refs
(AF Proj. 6670)
(AD-A056959; AFGL-TR-78-0024; AFGL-ERP-624) Avail: NTIS HC A03/MF A01 CSCL 04/2

A total of 511,056 hourly observations of visibility, taken over a 13 year period at nine stations, was studied to obtain a better understanding of the characteristics of persistence, runs, and recurrence. Each hourly visibility observation was categorized as either greater than or equal to 10 miles, greater than or equal to 5 miles, less than or equal to 3 miles, less than or equal to 1 mile (in summer), or less than or equal to 0.25 mile (in winter). Probabilities of each category were estimated from relative frequencies determined from this large data sample and were compared with some theoretical models. The models can be applied to estimate the probability that any visibility category will be observed for sequences of x hours, or more; for exactly x hours; or at time t, and also at time t-x hours. Author (GRA)

N79-10676# Air Force Geophysics Lab., Hanscom AFB, Mass.
CALCULATION OF THE BUOYANT MOTION OF A TURBULENT PLANAR HEATED JET IN AN OPPOSING AIR STREAM
Milton M. Klein 23 Mar. 1978 34 p refs
(AF Proj. 2093)
(AD-A056958; AFGL-TR-78-0072; AFGL-AFGS-385) Avail: NTIS HC A03/MF A01 CSCL 04/2

A broad experimental and theoretical program is being conducted to aid in the development of an operational warm fog dispersal system which utilizes momentum driven ground based heat sources. To help determine optimum heat and thrust combinations for the system, investigations are being made of the buoyant motion of heated turbulent jets both coflowing (wind and jet in the same direction) and counterflowing (wind and jet opposite). The investigation of the coflowing jet has been completed and in addition a model has been developed from which the dynamic characteristics of a heated counterflowing jet in the absence of buoyancy can be calculated. The present investigation is concerned with the effect of buoyancy upon the motion of a counterflowing jet. The lower portion of the trajectory, which has been calculated by the present model, is in fair to good agreement with the corresponding experimental curve, the calculated curve tending to be somewhat higher than that obtained experimentally. The calculated upper part of the trajectory, obtained from a model which gives the deflection of a jet in a crosswind, is in good agreement with experiment. GRA

N79-10677# Brookhaven National Lab., Upton, N. Y.
TURBULENCE DURING HIGH WIND EPISODES IN A COASTAL REGION
S. Sethuraman Mar. 1978 5 p refs Presented at 3d Conf. on Wind Engr. Res., Gainesville, Fla., 26 Feb. 1978
(Contract EY-76-C-02-0016)
(BNL-24190; Conf-780210-2) Avail: NTIS HC A02/MF A01

Turbulence in the atmospheric surface layer caused by aerodynamic roughness and temperture variations induces different degrees of mixing leading to various boundary layer processes. Random fluctuations of velocity and pressure in the atmosphere also causes random motions of structures, sometimes resonant in nature. Structural failures mostly occur during high wind conditions when the amplitudes of fluctuations are the highest and the scales of turbulence the smallest. Such failures occur due to the complex combination of the atmospheric turbulence and the structure induced turbulence. An investigation is made of the structure of turbulence in the atmospheric surface layer in a coastal area during high wind conditions and compare the results with similar observations inland. DOE

N79-10678# Aero Systems, Inc., Boulder, Colo.
TRACER DISPENSING AND RELATED SUPPORT ACTIVITIES CONDUCTED NEAR AUBURN, CALIFORNIA JANUARY THROUGH FEBRUARY 1978. TRACER DISPENSING AND RELATED STUDIES IN THE AMERICAN RIVER BASIN
William J. Carley and Frederick S. Solheim Apr. 1978 23 p (Contract DI-8007-83-BV0011)
(PB-282948/9) Avail: NTIS HC A02/MF A01 CSCL 04B

Tracer dispensing and support services for the Sierra Cooperative Pilot Project are described. A turbo-charged Piper Navajo was equipped for dispensing calibrated radar chaff and releasing silver iodide tracer materials from end-burning pyrotechnic units. The aircraft was also used for observation and photographic missions up to 24,000 feet. In addition to the airborne support, a four-wheel drive ground vehicle carrying portable silver iodide solution burning generators and equipped to measure and compute low-level winds and real-time using pibal methods was furnished. Ground crews recorded pressure altitude, wet and dry bulb temperature, and computed potential and equivalent potential temperature in real-time. GRA

N79-10679# National Center for Atmospheric Research, Boulder, Colo.
MULTIDISCIPLINARY RESEARCH RELATED TO THE ATMOSPHERIC SCIENCES
Michael H. Glantz, Harry VanLoon, and Elmer Armstrong Jun. 1978 330 p refs Sponsored in part of NSF
(PB-283076/8; NCAR-3141-78/1) Avail: NTIS HC A15/MF A01 CSCL 04B

The publication contains the papers presented at a Conference on Multidisciplinary Research related to the atmospheric sciences, held at the National Center for Atmospheric Research. The specific topics cover a wide range of disciplines with a potential relationship to the atmospheric sciences and to each other, such as; (1) the value of agro-meteorological information, (2) fisheries mangagement,(3) aquaculture, (4) global climatic changes due to energy conversion systems, (5) energy utilization, (6) problems in the CO2 balance (7) ocean thermal energy conversion systems, (8) environmental economics, (9) the economics of natural hazards, (10) inadvertent weather modification and the law (11) modeling of climatological forecasts for agricultural models and ecological aspects of the chemistry of atmospheric precipitation. GRA

N79-10680# Bohan (Walter A.) Co., Park Ridge, Ill.
ADVANCES IN THE UNDERSTANDING OF WEATHER SYSTEMS: A CONDENSATION OF THE FILM, A SATELLITE SUMMARY SMS-1 AND SMS-2
Nov. 1977 52 p refs
(Contract NOAA-6-16714)
(PB-284010/6; NOAA-78061701) Avail: NTIS HC A04/MF A01 CSCL 04B

The film summarizes some important views of cloud patterns associated with both mesoscale and macroscale weather systems as seen from the vantage point of the GOES. This text serves as a complement to the video tape and was designed to be used either in conjunction with or independently of the videotape. GRA

N79-10681# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE, NO. 5 Summary Report, 1976
Kirby J. Hanson Nov. 1977 119 p refs
(PB-283575/9; NOAA-78060524) Avail: NTIS HC A06/MF A01 CSCL 04B

Various atmospheric sampling programs are discussed. A sampling program for carbon dioxide (CO2) and Freon-11 was initiated at Niwot Ridge, Colorado, at an altitude of 3.6 km. This is representative of midcontinent, midlatitude clean air. A CO2 sampling program was reinitiated at Key Biscayne, Florida, after a break of 20 months. Increased control of parameters in chromatographic analysis has greatly reduced the scatter in the Freon-11 measurement at the baseline stations. An ion chromatograph was added to the geophysical monitoring climatic change program on the island of Hawaii for analysis of all major ions in precipitation chemistry samples. There was some evidence that activities on Alaska's north slope have decreased the sector from which clean air measurements can be obtained at the Barrow Observatory. GRA

N79-10682# National Oceanic and Atmospheric Administration, Boulder, Colo.
THE MAUNA LOA FOUR WAVELENGTH NEPHELOMETER: INSTRUMENT DETAILS AND THREE YEARS OF OBSERVATIONS
Barry A. Bodhaine Apr. 1978 45 p refs
(PB-284020/5; NOAA-TR-ERL-396; ARL-5; NOAA-78062004)
Avail: NTIS HC A03/MF A01 CSCL 04B

Three years of high quality total light scattering data from a four-wavelength integrating nephelometer were acquired at Mauna Loa Observatory as part of the geophysical monitoring for climate change program. These data may be representative of the upper troposphere under certain weather conditions and may be used to deduce background global aerosol properties and their possible effect on climate. GRA

N79-10683# Bureau of Reclamation, Denver, Colo. Office of Atmospheric Resources Management.
THE SIERRA COOPERATIVE PILOT PROJECT. PRECIPITATION MANAGEMENT RESEARCH IN THE SIERRA NEVADA
Edward R. Harris Apr. 1978 63 p refs
(PB-282430/8) Avail: NTIS HC A04/MF A01 CSCL 04B

Research, project design, environmental, coordination, and public involvement activities of the project are described. The technical feasibility and social acceptability of cloud seeding in the Sierra Nevada to supplement the region's water supply is examined. Results of the 1976-77 research season are reported, and the 1977-78 research program is explained. GRA

N79-10003# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
SNOW CONCENTRATION MEASUREMENTS AND CORRELATION WITH VISIBILITY
J. R. Stallabrass *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 10 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

N79-10004# Clermont-Ferrand Univ. (France). Lab. Associe de Meteorologie Physique.
MICROSTRUCTURE OF CLOUD GLACIATION [STRUCTURE MICROPHYSIQUE DES NUAGES GIVRANTS]
J. F. Gayet and R. G. Soulage *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 12 p refs In FRENCH (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

N79-10005# Luftfahrt-Bundesamt, Brunswick (West Germany).
METEOROLOGICAL ICING CONDITIONS
K. A. Vath *In* AGARD Icing Testing for Aircraft Eng. Aug. 1978 22 p refs (For primary document see N79-10002 01-01)
Avail: NTIS HC A10/MF A01

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N79-10684 Texas A&M Univ., College Station.
STRUCTURE AND SPREADING OF ANTARCTIC BOTTOM WATERS IN OCEANIC BASINS ADJACENT TO ANTARCTICA Ph.D. Thesis
Frederick Charles Schlemmer, II 1978 138 p
Avail: Univ. Microfilms Order No. 7817214

Descriptions of the characteristic relations, vertical structure and lateral spreading of Antarctic Bottom Water within the four major oceanic basins adjacent to Antarctica are presented. Three major layers of Antarctic Bottom Water are identified. Boundaries between these layers occur near the surfaces where the potential densities referenced to 4000 db are 46.08 mg cm superscript-3 46.15 mg cm superscript-3 (46.12 mg cm superscript-3 in the

Macquarie Ridge-Balleny Islands complex and western Southeast Pacific Basin) and 46.21 mg cm superscript-3. These isopycnal surfaces are associated with strata of maximum stability and slope changes in the characteristic relations. Dissert. Abstr.

N79-10685 Old Dominion Univ., Norfolk, Va.
THE RESPONSE OF AN IDEALIZED CONTINENTAL SHELF TO ATMOSPHERIC FORCING Ph.D. Thesis
Paul Francis Moersdorf 1978 175 p
Avail: Univ. Microfilms Order No. 7815002

The response of continental shelf water to cooling and wind stress is investigated using a two-dimensional numerical model. The circulation patterns were examined for dependence upon time, wind speed and air-sea temperature difference. The basic observation from all three of these analyses was that the shelf is wind dominated. Dissert. Abstr.

N79-10686 California Univ., San Diego.
SEDIMENT TRANSPORT DYNAMICS IN TIDAL INLETS Ph.D. Thesis
Steven Laurence Costa 1978 243 p
Avail: Univ. Microfilms Order No. 7814986

Sediment transport was investigated based on the assumptions that the discharge through natural inlets includes flows that exceed the condition of the threshold of sediment movement and that the magnitude of sediment transport is intimately related to the power expended on the bed. The anisotropic nature of small fluid velocity perturbations on the magnitude and direction of bed-load transport over a moveable rippled bed received particular attention. Laboratory experiments designed to be free of scale effects were conducted. The effects on sand transport in the channel of a model tidal inlet due to small velocity perturbations were determined for a range of tidal periods, amplitudes, and shapes. The size of the model and the associated tidal prism were also varied. Idealizations inherent in model experiments were investigated. Dissert. Abstr.

N79-10687 California Univ., San Diego.
STATISTICAL AND DYNAMICAL PREDICTION OF CHANGES IN NATURAL SAND BEACHES Ph.D. Thesis
David Glenn Aubrey 1978 213 p
Avail: Univ. Microfilms Order No. 7816759

The techniques of linear statistical predictors, empirical eigenfunctions, and Fourier analysis were used to statistically predict beach changes using a five-year data set of measured beach profiles and wave statistics. A dynamical model was tested to evaluate its ability to reproduce characteristic natural beach configurations. Finally, a five-year data set consisting of beach profile measurements was examined for long-term trends in profile development. Dissert Abstr.

N79-10688 Saint Louis Univ., Mo.
REGIONALIZED SHEAR VELOCITY MODELS BENEATH THE PACIFIC OCEAN FROM LOVE AND RAYLEIGH WAVE DISPERSION Ph.D. Thesis
Guey-Kuen Yu 1978 193 p
Avail: Univ. Microfilms Order No. 7814660

Group and phase velocities for periods between 16 and 110 seconds were determined using the single-station method along thirty-three Rayleigh- and thirsty Love-wave paths across the Pacific. These dispersion data were used to detect variations in upper mantle structure beneath the Pacific. Taking both regional changes and azimuthal variation into consideration, the regionalized group and phase velocities were derived for four regions of differing age. The azimuthal anisotropy is small (less than 0.8 percent), but significant if the degree of the azimuthal anisotropy is assumed to be uniform throughout the entire Pacific. The direction of maximum velocity is roughly 85 deg + or - 6 deg or 265 deg + or - 6 deg as measured clockwise from north. Regionalized group and phase velocities for Rayleigh waves increase systematically with increasing age of the ocean-floor; however, the Love wave data do not increase in the same systematic way. Dissert. Abstr.

N79-10689*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OCEANIC WAVE MEASUREMENT SYSTEM Patent Application
John F. Holmes (Computer Sciences Corp., Bay St. Louis, Miss.) and Ronald T. Miles, inventors (to NASA) (Computer Sciences Corp., Bay St. Louis, Miss.) Filed 16 Oct. 1978 13 p Sponsored by NASA
(NASA-Case-MFS-23862-1; US-Patent-Appl-SN-951423) Avail: NTIS HC A02/MF A01 CSCL 08C

A system which utilizes a barometer to measure oceanic waves is presented. The basic novelty of the invention lies in combining the technique of obtaining a height signal by barometric measurement and effecting crest-to-trough measurements each half cycle of wave motion, whereby a complete history of crest-to-trough and trough-to-crest measurements is recorded. The invention conveniently provides for the additional measurements of average wave frequency and significant wave height.
NASA

N79-10690# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
DEEP OCEAN MINING: ACTIONS NEEDED TO MAKE IT HAPPEN Report to the Congress
28 Jun. 1978 78 p refs
(PB-283071/9; PSAD-77-127) Avail: NTIS HC A05/MF A01 CSCL 08I

There are two major constraints on U.S. mining firms, which will probably delay mining if they are not resolved. The primary problem is the need for mining site tenure at specific deep sea locations guaranteed by domestic law or international agreement. The second problem is the need for the Federal Government to complete a series of environmental studies or assessments and to develop environmental regulations before commercial mining operations begin so that mining equipment, operating techniques, and refineries are environmentally acceptable. GAO believes that the various agencies' support of deep ocean mining should be coordinated in an overall program. Accordingly, GAO recommends that the Office of Management and Budget, with the advice of the Office of Science and Technology Policy, designate a primary Federal authority to determine the federal role and develop for congressional approval a comprehensive program to implement federal responsibilities in accordance with national objectives.
GRA

N79-10691# Texas Univ. at Austin. Center for Research in Water Resources.
METHODOLOGY TO EVALUATE ALTERNATIVE COASTAL ZONE MANAGEMENT POLICIES: APPLICATION IN THE TEXAS COASTAL ZONE. EXAMPLE APPLICATION 4: TRANSFERABILITY OF METHODOLOGY TO THE LOWER RIO GRANDE VALLEY Final Report
E. G. Eruh and Robert S. Kier 1977 394 p refs
(Grant NSF AEN-74-13590-A01)
(PB-282857/2; NSF/RA-770513) Avail: NTIS HC A17/MF A01 CSCL 13B

The methodology to evaluate environmental and economic impacts of alternative coastal zone management policies was applied in the Lower Rio Grande Valley (LRGV) to test its transferability to different regions of Texas and the United States. The area of the LRGV, consists of Cameron, Hidalgo, and Willacy counties. Reports are presented on (1) summary of investigation in the lower Rio Grande Valley; (2) land use task group; (3) economics task group; (4) resource capability units task group; (5) resource use and residuals management task group; (6) estuarine modeling task group; and (7) biological uses criteria task group. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N79-10692 California Univ., Irvine.
ALGAL GROWTH UNDER MULTIPLE NUTRIENT LIMITING CONDITIONS Ph.D. Thesis
Richard A. Appleman 1978 150 p
Avail: Univ. Microfilms Order No. 7815833

Batch and continuous culture algal bioassays were used to: determine if multiple nutrient-limited growth occurs for the green alga Selenasturm capricornutum, define and characterize the

growth conditions for which this phenomenon occurs, and test the validity of the previously proposed models under these conditions. Test conditions and growth medium were similar to those specified in the Environmental Protection Agency's Algal Assay Procedure-Bottle Test. Nitrogen and phosphorus were used as the test nutrients with algal growth monitored using an electronic particle counter. Dissert. Abstr.

N79-10693* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
WATER SYSTEM VIRUS DETECTION Patent
Alan S. Fraser (Organon Diagnostics, El Monte, Calif.), Arthur F. Wells (Organon Diagnostics, El Monte, Calif.), and Harold J. Tenoso, inventors (to NASA) (Organon Diagnostics, El Monte, Calif.) Issued 3 Oct. 1978 7 p Filed 28 Apr. 1977 Sponsored by NASA
(NASA-Case-MSC-16098-1; US-Patent-4,118,315;
US-Patent-Class-210-96M; US-Patent-Class-210-433M) Avail: US Patent Office CSCL 06M

The performance of a waste water reclamation system is monitored by introducing a non-pathogenic marker virus, bacteriophage F2, into the waste-water prior to treatment and, thereafter, testing the reclaimed water for the presence of the marker virus. A test sample is first concentrated by absorbing any marker virus onto a cellulose acetate filter in the presence of a trivalent cation at low pH and then flushing the filter with a limited quantity of a glycine buffer solution to desorb any marker virus present on the filter. Photo-optical detection of indirect passive immune agglutination by polystyrene beads indicates the performance of the water reclamation system in removing the marker virus. A closed system provides for concentrating any marker virus, initiating and monitoring the passive immune agglutination reaction, and then flushing the system to prepare for another sample.
Official Gazette of the U.S. Patent Office

N79-10694* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYSTEM FOR AND METHOD OF FREEZING BIOLOGICAL TISSUE Patent
Thomas E. Williams and Thomas A. Cygnarowicz, inventors (to NASA) Issued 3 Oct. 1978 7 p Filed 14 Jun. 1977 Supersedes N77-27693 (15 - 18, p 0789)
(NASA-Case-GSC-12173-1; US-Patent-4,117,881;
US-Patent-Appl-SN-806440; US-Patent-Class-165-2;
US-Patent-Class-165-30; US-Patent-Class-62-78;
US-Patent-Class-62-514R; US-Patent-Class-195-1.8;
US-Patent-Class-219-299; US-Patent-Class-219-302) Avail: US Patent Office CSCL 06B

Biological tissue is frozen while a polyethylene bag placed in abutting relationship against opposed walls of a pair of heaters. The bag and tissue are cooled with refrigerating gas at a time programmed rate at least equal to the maximum cooling rate needed at any time during the freezing process. The temperature of the bag, and hence of the tissue, is compared with a time programmed desired value for the tissue temperature to derive an error indication. The heater is activated in response to the error indication so that the temperature of the tissue follows the desired value for the time programmed tissue temperature. The tissue is heated to compensate for excessive cooling of the tissue as a result of the cooling by the refrigerating gas. In response to the error signal, the heater is deactivated while the latent heat of fusion is being removed from the tissue while the tissue is changing phase from liquid to solid.
Official Gazette of the U.S. Patent Office

N79-10695# National Technical Information Service, Springfield, Va.
EUTROPHICATION. VOLUME 2: A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Jul. 1977
Elizabeth A. Harrison Aug. 1978 242 p
(NTIS/PS-78/0771/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 06F

The selected abstracts cover all aspects of eutrophication, including research on primary productivity, water chemistry, ecology, the influence and impact of nutrients on lakes and streams, control techniques, and mathematical modeling. This updated bibliography contains 235 abstracts, none of which are new entries to the previous edition. GRA

N79-10696# National Technical Information Service, Springfield, Va.
EUTROPHICATION. VOLUME 3: A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Aug. 1977 - Jul. 1978
Elizabeth A. Harrison Aug. 1978 72 p Supersedes NTIS/PS-77/0687; NTIS/PS-76/0582; NTIS/PS-75/523; NTIS/PS-74/090 (NTIS/PS-78/0772/0; NTIS/PS-77/0687; NTIS/PS-76/0582; NTIS/PS-75/523; NTIS/PS-74/090) Avail: NTIS HC $28.00/MF $28.00 CSCL 06F

The selected abstracts cover all aspects of eutrophication, including research on primary productivity, water chemistry, ecology, the influence and impact of nutrients on lakes and streams, control techniques, and mathematical modeling. This updated bibliography contains 65 abstracts, all of which are new entries to the previous edition. GRA

N79-10697# Woods Hole Oceanographic Institution, Mass.
IMPACT OF LARGE SCALE AQUATIC BIOMASS SYSTEMS
Thomas Hruby Mar. 1978 32 p refs
(Grant NOAA-04-7-158-44104)
(PB-282617/0; WHOI-78-31; NOAA-78051603) Avail: NTIS HC A03/MF A01 CSCL 08A

The environmental impacts for several systems proposed for the large-scale culture of algae and other aquatic plants are presented. The impacts of algal biomass production are considered in terms of production on land, open ocean, and the coasts. The areas where dangers exist and where additional research is needed are identified. Only primary impacts are considered. GRA

N79-10698# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND AEROSPACE MEDICINE, VOL 12, NO. 5, 1978
26 Oct. 1978 138 p refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 1-90
(JPRS-72115) Copyright. Avail: NTIS HC A06/MF A01

The physiological effects of space flight stress on humans and animals are evaluated. For individual titles, see N79-10699 through N79-10721.

N79-10699# Joint Publications Research Service, Arlington, Va.
NEUROPHYSIOLOGICAL BASES OF VESTIBULAR CONDITIONING c52
G. I. Gorgiladze *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 1-13 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 3-11 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

Processes of vestibular habituation include repeated stimulation of the labyrinthine receptors. Development of habituation is manifested by a progressive attenuation of evoked reactions to recurrent stimulation, retention of the attenuated reaction for a certain period of time, and finally transfer of habituation to neurons that have an inhibitory effect on vestibular afferentation. G.G.

N79-10700# Joint Publications Research Service, Arlington, Va.
PROTEIN FRACTIONS AND ENZYMATIC ACTIVITY THEREOF IN THE RAT MYOCARDIUM AFTER THE FLIGHT ON KOSMOS-690 BIOSATELLITE
M. S. Gayevskaya, Ye. V. Kolchina, Ye. A. Nosova, N. S. Kolganova, and N. A. Veresotskaya *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 14-18 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 12-15 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

Exposure of rats during space flight to gamma radiation lowered AST activity of myocardial sarcoplasmic proteins. However, with respect to ATPase of myocardial myosin, the effect of weightlessness was stronger than that of radiation, and as a result the activity of this enzyme was low both on the

1st and 26th days after the biosatellite landed. It is assumed that radiation-induced inhibition of biosynthetic processes affected synthesis of myosin and lowered the protein content of the myocardial fraction T on the first day after space flight. Gamma radiation delivered in a ground-based control experiment lowered AST activity of myocardial sarcoplasmic proteins and raised the activity of ATPase of myocardial myosin on the first and 26 days after the experiment. G.G.

N79-10701# Joint Publications Research Service, Arlington, Va.

RECOVERY OF HEMOPOIESIS IN RATS EXPOSED TO RADIATION DURING SPACE FLIGHT

M. P. Kalandarova, G. P. Rodina, and T. M. Smirnova *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 19-25 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 15-20 (For primary document see N79-10698 01-51)

Avail: NTIS HC A06/MF A01

Repair regeneration in the hemopoietic system of rats exposed to radiation during a space flight was studied. Comparative analysis of the obtained data indicates that prolonged weightlessness could influence, to some extent, the course of a pathological process, in particular radiolesion to hemopoiesis. G.G.

N79-10702# Joint Publications Research Service, Arlington, Va.

RADIATION LESION TO LIVER DNA OF RATS EXPOSED TO RADIATION DURING FLIGHT ABOARD THE KOSMOS-690 BIOSATELLITE

G. S. Komolova, V. F. Makeyeva, I. A. Yegorov, R. A. Tigranyan, and Yu. G. Grigoryev *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 26-30 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 21-23 (For primary document see N79-10698 01-51)

Avail: NTIS HC A06/MF A01

Intrinsic viscosity test data on DNA from rat livers after termination of the flight and from synchronous experiments are reported. Animals in the control experiment were exposed to a dosage of approximately 220 rad radiation; their intrinsic viscosity values for native and denatured DNA (NDNA and ODNA) of the liver did not differ from figures obtained in intact controls. At the same time, with the same dosage delivered to animals in the flight experiment, the value of 17% and 38%, for NDNA and ODNA, respectively, was lower than in intact controls. The postflight drop in values of NDNA and ODNA indicates single-stranded and paired breaks in the DNA molecules. G.G.

N79-10703# Joint Publications Research Service, Arlington, Va.

HISTOLOGICAL AND HISTOCHEMICAL STUDIES OF THE LIVER OF RATS FLOWN ABOARD KOSMOS-690 BIOSATELLITE

V. I. Yakovleva *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 31-34 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 24-26 (For primary document see N79-10698 01-51)

Avail: NTIS HC A06/MF A01

Delivery of 800 rad radiation in one day to rats involved in space flight, as well as in a control experiment, led to the development of the same morphological changes. This warrants the conclusion that space flight conditions do not have a modifying effect on the course of radiation lesion to the liver (according to the results of histological and histochemical studies). G.G.

N79-10704# Joint Publications Research Service, Arlington, Va.

STATE OF SPERMATOGENESIS IN RATS FLOWN ABOARD KOSMOS-690 BIOSATELLITE

G. I. Plakhuta-Plakutina *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 35-40 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 26-31 (For primary document see N79-10698 01-51)

Avail: NTIS HC A06/MF A01

Radiation effects under weightlessness conditions were studied on the reproductive glands of 30 male Wistar rats flown aboard Cosmos-690 and submitted to prolonged gamma-radiation on the 10th day of the flight. Histological examination of the testes on the first to second day after the flight (11th-12th postradiation day, after delivery of doses of 220 and 800 rad) revealed significant destruction of spermatogonia with relatively high degree of preservation of subsequent cell generations of sex cells in the seminiferous tubules, in addition to marked dystrophic changes. After delivery of 955 rad, there was marked atrophy of spermatogenic epithelium without signs of recovery by the 36th postradiation day. G.G.

N79-10705# Joint Publications Research Service, Arlington, Va.

RAT BEHAVIOR IN MAZE AFTER FLIGHT ABOARD KOSMOS-690 BIOSATELLITE **c53**

N. N. Livshits, Z. I. Apanasenko, M. A. Kuznetsova, and Ye. S. Meyzerov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 41-46 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 31-35 (For primary document see N79-10698 01-51)

Avail: NTIS HC A06/MF A01

The differences between behavior in the maze of rats irradiated in flight and in a ground-based control experiment were not consistent. Changes in behavior after irradiation in flight were more marked according to some indices (refusal to go through the maze with a higher functional load), while irradiation on the ground under the conditions of the control experiment was more effective (damaging) according to other indices (refusal to go through the maze in the recovery period, reactions to development of second and third skills). G.G.

N79-10706# Joint Publications Research Service, Arlington, Va.

CHANGES IN BLOOD SUGAR CONTENT OF DOGS EXPOSED TO CHRONIC GAMMA RADIATION FOR SIX YEARS

A. A. Akhunov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 47-52 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 35-39 (For primary document see N79-10698 01-51)

Avail: NTIS HC A06/MF A01

A six year chronic and combined gamma irradiation study on dogs exposed to doses of 125, 370, 720, 750 and 1130 rad found a change in blood sugar content. The changes were phasic and probably due to deviations in mechanisms of neuroendocrine regulation of sugar metabolism. Certain differences were demonstrated between irradiated and control animals, with respect to their reactions to various loads. G.G.

N79-10707# Joint Publications Research Service, Arlington, Va.

ANALYSIS OF DISTRIBUTION OF SEQUENCES OF R-R INTERVALS IN ASTRONAUTS: GENERALIZED COORDINATE METHOD

Yu. M. Svirezhev, N. I. Vikhrov, and V. I. Kozharinov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 53-57 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 39-43 (For primary document see N79-10698 01-51)

Avail: NTIS HC A06/MF A01

Some distinctions in the distribution of R-R intervals are discussed. Since it was demonstrated that R-R distributions are nonstationary, they cannot be described by known canonical distributions. A plotting method, or method of generalized coordinate, is offered to describe the dynamics of change in structure of heart rhythm in astronauts. G.G.

N79-10708# Joint Publications Research Service, Arlington, Va.

COMPENSATORY REACTIONS OF THE KIDNEYS TO ORTHOSTATIC FACTORS **c52**

Ye. A. Ilin, V. I. Korolkov, K. V. Stelingovskiy, E. V. Tyurina, V. P. Berezov, and V. F. Zenin *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 58-62 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm.

Med. (Moscow), no. 5, 1978 p 43-46 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

Excretory function of the kidneys, as a system that is functionally linked with hemodynamic effects, is of substantial significance in compensatory reactions to orthostasis. A comprehensive study of cardiovascular functions and excretory functions of the kidneys is detailed and their role in compensatory reactions to an orthostatic load is determined. Orthostasis led to an increase in the heart rate of dogs with a drop of arterial pressure and pressure in the right atrium. Along with the changes in hemodynamic parameters, decreased diuresis, as well as a significant decrease in concentration of Na ions in urine, was demonstrated. G.G.

N79-10709# Joint Publications Research Service, Arlington, Va.

CLINICAL AND MORPHOLOGICAL STUDIES OF PEOPLE IN THE COURSE OF LONG-TERM HYPOKINESIA AND SUBSEQUENT READAPTATION c52

V. P. Dygin, V. A. Maksimov, V. G. Shubin, N. T. Sverdlina, and N. M. Leshchenko *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 63-67 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 46-50 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

The results of a complex and dynamic immunological study show that long-term (44-46 days) hypokinesia may lead to appearance of cardiac antigen in about 50% of essentially healthy subjects. This is attributed to increased resportion of protein structures by the myocardium due to autolytic or dystrophic processes. Anticardiac antibodies were not demonstrated. G.G.

N79-10710# Joint Publications Research Service, Arlington, Va.

CARDIAC ARRHYTHMIA FOLLOWING POSTIMMERSION +G SUB z ACCELERATIONS c52

I. F. Vil-Vilyams and Ye. B. Shulzhenko *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 68-75 refs Trans. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 50-56 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

Data were obtained that indicate a significant change in the functional state of the cardiovascular system during many days of immersion which, in particular, is manifested by more frequent and prognostically more serious development of extrasystolic arrhythmia with subsequent exposure to head-pelvis accelerations. The following factors probably play the leading role in the genesis of breakdown of compensatory mechanisms of regulation of cardiac function with exposure to +G sub z accelerations after immersion: increased tonus of the parasympathetic nervous system, changes in systemic and regional circulation, and impairment of fluid-electrolyte balance of the body. G.G.

N79-10711# Joint Publications Research Service, Arlington, Va.

EFFECTS OF VIBRATION AND NOISE ON SOME INDICES OF EFFICIENCY OF MI-4 HELICOPTER CREWS c54

Yu. N. Kamenskiy and Ye. A. Sokolova *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 76-81 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 56-59 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

The majority of Mi-4 pilots assessed noise (87.9%) and vibration (69.7%) as strong and unpleasant during the flight. Many reported intensification of these factors during take-offs, landings and hovering (there were up to 10-12 take-offs and landings per work day). Subjectively, there was a feeling of fatigue, buzzing in the ears and occasional headache. In the course of the work day, there was an appreciable change in visual function of Mi-4 pilots, with impairment of musculoarticular sensibility, and deterioration of conditioned reflex activity and capacity for fine coordination of movements. A comparison of the findings obtained on Yak-40 pilots warrants the conclusion that these changes in Mi-4 pilots were due primarily to the effects of vibration and noise inherent in that helicopter. The intensity of these changes is apparently related to the prolonged effects of vibration and noise on the pilots. G.G.

N79-10712# Joint Publications Research Service, Arlington, Va.

TISSULAR RESPIRATION OF THE BRAIN AFTER EXPOSURE OF RATS TO HYPERTOXIC HELIUM AND OXYGEN MIXTURES AT ATMOSPHERIC AND ELEVATED PRESSURE

G. V. Troshikhin and T. T. Podvigina *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 82-87 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 59-63 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

A five hour exposure of rats to a hyperoxic helium and oxygen mixture containing 0.40 kG/sq cm oxygen, at atmospheric and elevated pressure, did not induce changes in mitochondrial metabolism in the cerebral cortex. However a 5-day exposure to a helium and oxygen mixture at elevated pressure (40 kG/sq cm) with partial oxygen pressure of 0.40 kG/sq cm decreased uptake of oxygen and inorganic phosphate by cerebrocortical mitochondria. G.G.

N79-10713# Joint Publications Research Service, Arlington, Va.

EFFECTS OF ENDOGENOUS FACTORS ON THE PROCESS OF GAS BUBBLE FORMATION IN THE BODY RELATED TO DECOMPRESSION c52

K. S. Yurova *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72215) 26 Oct. 1978 p 88-93 ref Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 63-67 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

Animal experiments investigated the effect of feeding schedule and quality of diet on intensity of production of gas bubbles in the internal media of the organism after decompression, the effect of prior increased and decreased exercise on this process, and the correlation between intensity of postdecompression gas formation in animal blood and physicochemical and morphological blood indices. Feeding regimen did not have an appreciable effect on post-decompression gas production in young rats weighing up to 200 g; conversely, the regimen and ration altered, with statistical reliability, the intensity of gas production. Profuse feeding without a fat load and, even more so, with a fat load increased postdecompression gas production. Increased exercise prior to decompression increased, with statistical reliability, the probability of postdecompression gas production and, at the same time, enhanced gas formation and the development of decompression disorders under such conditions. G.G.

N79-10714# Joint Publications Research Service, Arlington, Va.

CHARACTERISTICS OF VESTIBULAR NYSTAGMUS IN RATS

A. A. Shipov and V. G. Ovechkin *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 94-100 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 68-72 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

The overall characteristics of the vestibular nystagmus of rats, in response to a series of progressively increasing accelerations, show that the duration, number of beats and frequency of nystagmus increase with increase in accelerations. The rate of increase gradually decreased and the number of beats increased faster than duration. The frequency of nystagmus builds up the slowest. G.G.

N79-10715# Joint Publications Research Service, Arlington, Va.

CHARACTERISTICS OF BACTERIAL AEROSOL IN AIR-TIGHT ROOMS OCCUPIED BY HUMANS

S. N. Zaloguyev, A. N. Viktorov, and G. O. Pozharskiy *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978

(JPRS-72115) 26 Oct. 1978 p 101-105 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5 1978 p 72-75 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

The formation of bacterial aerosol in people-occupied airtight rooms was studied by determining the number of particles in the droplet and droplet-nuclear phases of aerosol in relation to the conditions under which humans generate aerosol particles. Obtained data show a finely divided aerosol is formed in the air of an airtight room occupied by humans. This is one of the factors that is favorable to transmission of conditionally pathogenic microorganisms under these specific conditions. G.G.

N79-10716# Joint Publications Research Service, Arlington, Va.
DECREASED ACTIVITY OF PALLADIUM CATALYST DURING PROCESSING OF EXCRETA **c54**
G. S. Dinyak and L. A. Margolis *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 106-109 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 76-78 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

The volatile compounds, that are formed as a result of processing human excreta, decrease the catalytic activity of palladium. The effects of water vapor and admixture of hydrogen sulfide, as components in a real gas, on the activity of a palladium catalyst were studied. Methane was selected as the component that is the most difficult to oxidize. Test results show that it is imperative to prevent access of hydrogen sulfide to assure long-term operation of a palladium catalyst. A barium-aluminovanadium catalyst can be used as preliminary catalytic purifier, in which the degree of oxidation of hydrogen sulfide constitutes 92% at 200 C, while the formed sulfur oxides can be readily adsorbed in the condensate. A gas mixture containing 3 to 5 mg hydrogen sulfide lowers palladium catalyst activity by 80% and virtually fails to lower the activity of a two-layer mixture consisting of palladium and barium-aluminovanadium contacts. G.G.

N79-10717# Joint Publications Research Service, Arlington, Va.
A METHOD OF EVALUATING THE PUPILLARY REACTION TO VESTIBULAR STIMULI **c52**
E. V. Lapayev, G. I. Pavlov, G. V. Anisimov, O. A. Cherkasov, and M. I. Katalov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 110-116 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 19-82 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

Pupillography was performed before exposure to Coriolis and angular accelerations, as well as immediately after exposure and every minute for 10 min in the aftereffect period. Accelerations were produced on the electric revolving chair turning at the rate of 180 deg/s. Results reveal that the diameter of the pupil changes over a wide range after exposure to accelerations. The severity of the reaction was related to the subjects' individual endurance. G.G.

N79-10718# Joint Publications Research Service, Arlington, Va.
COMPARATIVE ANALYSIS OF CAUSES OF ANIMAL DEATHS DURING CHRONIC EXPOSURE TO GAMMA RADIATION AND THE AFTEREFFECT PERIOD
V. I. Yakovleva and A. S. Pankova *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 117-121 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 82-84 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

Experimental data indicate that malignant tumors occupy the most prominent place among the causes of death of animals exposed to chronic radiation. This shows that tumors of diverse morphological structure and localization can develop after long-term exposure to gamma radiation at a low dose rate. G.G.

N79-10719# Joint Publications Research Service, Arlington, Va.
EFFECTS OF LONG-TERM AND CHRONIC RADIATION ON HEMOPOIESIS **c52**
T M Zukhbaya *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 122-125 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 85-86 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

Phasic changes in hemopoietic rat tissue were observed in the course of long-term irradiation. The clinical effect of radiation was very consistent with the degree of depression of myelokaryocyte number in the period preceding the phase of activation of hemopoiesis, and it was directly related to the dose rate.G.G.

N79-10720# Joint Publications Research Service, Arlington, Va.
EFFECT OF ACCELERATIONS COMBINED WITH RADIATION ON OCCURRENCE OF GENE MUTATIONS IN THE DROSOPHILA
A. V. Rostopshina *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 126-128 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 86-88 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

Radiation induced a reliable increase in incidence of lethal recessive mutations at the stages of mature spermia, spermatids, and spermatocytes. Radiation did not increase the incidence of mutations at the stage of late spermatogonia. Accelerations followed by radiation induced an increased incidence of mutations at all of the spermatogenetic stages considered, and this was reliably different from the effect induced by radiation alone only at the stage of late spermatogonia. It is important to note that radiation alone at this stage does not increase the incidence of mutations, whereas when accelerations preceded radiation the effect was quite marked. The incidence of mutations in the case of accelerations following radiation did not differ from the incidence of mutations after radiation alone. Centrifuging had a modifying effect on the radiation effect only at the stage of late spermatogonia in the case of accelerations preceding radiation. G.G.

N79-10721# Joint Publications Research Service, Arlington, Va.
EFFECT OF OXYGEN POISONING ON THE SPECTRUM OF LACTATE DEHYDROGENASE ISOZYMES OF RABBIT BLOOD PLASMA
N. A. Sokolova *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 129-132 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 88-90 (For primary document see N79-10698 01-51)
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Evaluation of the overall activity and spectrum of LDH isozymes in rabbit blood plasma failed to demonstrate an influence by therapeutic hyperbaric oxygenation. Data on the effect of toxic HBO on overall activity and spectrum of LDH isozymes, as well as aspartate aminotransferase activity in rabbit blood plasma, are indicative of accelerated discharge of enzymes from various organs and tissues, which could be due to impaired permeability of cell membranes under the influence of hyperoxia. G.G.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N79-10722 North Dakota Univ., Grand Forks.
APPLIED ANALYSIS OF COMPUTER SIMULATED DECOMPRESSION PROFILES Ph.D. Thesis
Stephen Jack Settle 1977 165 p
Avail: Univ. Microfilms Order No. 7816002

A computer simulated decompression model was empirically tested for reliability and predictability. Bends-threshold levels in

decompression were evaluated by comparing continuous decompressions and maximum-step decompressions. The model incorporated seven tissue compartments (lung, blood, bone, skin, interstitial fluid, intracellular fluid and fat) modeled in a parallel fashion. Each tissue compartment was expressed in terms of a resistance-capacitance circuit. The differential equation $dPC/dt = (PC - PE)/RC$ described the rate of change of compartmental pressure in terms of PC = compartmental pressure, PE = environmental pressure, and RC = resistance times capacitance. Decompression profiles were simulated on the IBM 370 using continuous system modeling program. Dissert. Abstr.

N79-10723 Pennsylvania Univ., Philadelphia.
ANALYSIS OF INERT GAS EXCHANGE IN THE MIDDLE EAR Ph.D. Thesis
Ashok Ranade 1978 251 p
Avail: Univ. Microfilms Order No. 7816346

Mechanical stimuli to the inner ear induced by diffusion of gases into the endolymphatic fluid of the vestibular organ were studied. The gases present in the middle ear cavity may produce vestibular symptoms of vertigo, nausea and nystagmus. A mathematical description was developed to define the exchange of ambient and respired gases in terms of the solubility, diffusion and blood perfusion characteristics of the tympanic membrane and the mucosal layer of the middle ear cavity. It also incorporates the venting function of the eustachian tube. A computer solution of the equation shows good agreement with experimental data. Computer simulation studies indicate that the diffusion of gases across the tympanic membrane is not significantly affected by the membrane's blood supply and that the diffusion of gases across the mucosal layer is perfusion-limited. Dissert. Abstr.

N79-10724* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONTOUR DETECTOR AND DATA ACQUISITION SYSTEM FOR THE LEFT VENTRICULAR OUTLINE Patent
Johan H. C. Reiber, inventory (to NASA) Issued 18 Jul. 1978 19 p Filed 16 Feb. 1977 Supersedes N77-17701 (15 - 08, p 1069)
(NASA-Case-ARC-10985-1; US-Patent-4,101,961; US-Patent-Appl-SN-769148; US-Patent-Class-364-417; US-Patent-Class-358-96; US-Patent-Class-358-111; US-Patent-Class-128-2.05R) Avail: US Patent Office CSCL 06B

A real-time contour detector and data acquisition system is described for an angiographic apparatus having a video scanner for converting an X-ray image of a structure characterized by a change in brightness level compared with its surrounding into video format and displaying the X-ray image in recurring video fields. The real-time contour detector and data acquisition system includes track and hold circuits; a reference level analog computer circuit; an analog compartor; a digital processor; a field memory; and a computer interface.
Official Gazette of the U.S. Patent Office

N79-10725* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 184
Sep. 1978 51 p
(NASA-SP-7011(184)) Avail: NTIS HC E03 CSCL 06E

This bibliography lists 139 reports, articles, and other documents introduced into the NASA scientific and technical information system in August 1978. Author

N79-10726 Rochester Univ., N. Y.
NONINVASIVE ULTRASONIC BLOOD FLOW CHARACTERIZATION Ph.D. Thesis
Paul Poo-Kam Lee 1978 163 p
Avail: Univ. Microfilms Order No. 7818271

A new method of transcutaneous ultrasonic characterization of blood flow in the chambers of the heart and great vessels is proposed. The basic model considers acoustic propagation and scattering in an inhomogeneous moving medium. The results are intended for noninvasive characterization of blood flow and specialize for differentiation of tissue when the medium is motionless. The theory also provides a unified approach to ultrasonic flow measurement employing the Doppler principle. Computer simulations were carried out to evaluate the performance of the Doppler system when the quadrature signals are corrupted with white noise and when phase instabilities of the detection system produce jitter. The ultrasonic method was also used to show the growth of turbulence in a jet. The in vitro experimental studies show the utility of the model.
Dissert. Abstr.

N79-10727 Johns Hopkins Univ., Baltimore, Md.
LUNG MECHANICS: DYNAMIC RESPONSE, ACOUSTIC GENERATION, AND FLOW LIMITATION Ph.D. Thesis
James Bernard Grotberg 1978 178 p
Avail: Univ. Microfilms Order No. 7816682

Collapsible tube flutter is mathematically modelled by an inviscid, incompressible fluid flowing through an infinite, two-dimensional, flexible channel. The allowed natural frequencies (wave speeds) of oscillation are determined for both small amplitude and finite amplitude, nonlinear oscillations. The bifurcation theory of dynamic instability and flow over a corrugated flexible boundary are also examined. Clinical correlations to the production of wheezing sounds in the lung and Korotkoff sounds in the blood vessels are discussed. The dynamical effect of varying the cycling frequency of eight isolated dog lobes is measured by documenting corresponding changes in the dynamic compliance and hystersis area of their pressure-volume loops. Loops were recorded at eight frequencies between 0.1 cpm and 50.0 cpm. Dissert. Abstr.

N79-10728*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HYPERTHERMIA AS AN ANTINEOPLASTIC TREATMENT MODALITY
Sheila Ann T. Long, ed., James Shaeffer, ed. (Eastern Va. Med. School), and Anas M. El-Mahdi, ed. (Eastern Va. Med. School) 1978 96 p refs Symp. held at Norfolk, Va., 28 Jan. 1978 (NASA-CP-2051; L-12082) Avail: NTIS HC A05/MF A01 CSCL 06E

Preclinical evaluation of hyperthermia for treating tumerous cancers is discussed. For individual titles, see N79-10729 through N79-10733.

N79-10729*# Virginia Univ. Hospital, Charlottesville. Div. of Radiation Oncology.
HYPERTHERMIA IN THE TREATMENT OF CANCER: A REVIEW OF THE RADIOBIOLOGICAL BASIS
Donald G. Baker *In* NASA. Langley Res. Center Hyperthermia as an Antineoplastic Treatment Modality 1978 p 3-24 refs (For primary document see N79-10728 01-52)
Avail: NTIS HC A05/MF A01 CSCL 06E

Temperatures in the range 41.5 C to 43.5 C tend to be more damaging to malignant than nonmalignant cells. Where local hyperthermia (41.5 C to 43.5 C) is combined with ionizing radiation, a significant therapeutic ratio may be realized. Total body hyperthermia, alone or combined with other therapeutic modalities, can provide palliation for some systemic malignancies but may not be as effective as local hyperthermia for treating local disease. The influence of hyperthermia on immune mechanisms and the risk of metastatic spread of potential tumor growth stimulation need further investigation. Among other questions needing elucidation before hyperthermia can be considered a standard treatment modality are the time-dose (for heating) relationships to produce an optimal therapeutic ratio and whether the late sequela of combined heat and ionizing radiation may result in an unacceptable risk of patient morbidity. Author

N79-10730*# Maryland Univ., College Park. School of Medicine.
TEMPERATURE UNIFORMITY IN HYPERTHERMAL TUMOR THERAPY
George H. Harrison, J. Eugene Robinson, and George M. Samaras *In* NASA. Langley Res. Center Hyperthermia as an Antineoplastic Treatment Modality 1978 p 27-32 refs (For primary document see N79-10728 01-52)
(Grants Am. Cancer Soc. PDT-33; LA-18872-01)
Avail: NTIS HC A05/MF A01 CSCL 06E

Mouse mammary tumors heated by water bath or by microwave-induced hyperthermia exhibit a response that varies

sharply with treatment temperature; therefore, uniform heating of the tumor is essential to quantitate the biological response as a function of temperature. C3H tumors implanted on the mouse flank were easily heated to uniformities within 0.1 C by using water baths. Cold spots up to 1 C below the desired treatment temperature were observed in the same tumors implanted on the hind leg. These cold spots were attributed to cooling by major blood vessels near the tumor. In this case temperature uniformity was achieved by the deposition of 2450 MHz microwave energy into the tumor volume by using parallel-opposed applicators. Author

N79-10731*# Medical Coll. of Virginia, Richmond. Div. of Radiation Biology.

THE EFFECT OF HYPERTHERMIA ON THE RADIATION RESPONSE OF CRYPT CELLS IN MOUSE JEJUNUM

John D. Wilson *In* NASA. Langley Res. Center Hyperthermia as an Antineoplastic Treatment Modality 1978 p 33-43 refs (For primary document see N79-10728 01-52)
Avail: NTIS HC A05/MF A01 CSCL 06E

The effect of hyperthermia and/or gamma-radiation on the survival of intestinal crypt cells was studied in BDF sub 1 mice using a microcolony assay. Hyperthermia treatments, which in themselves caused no detectable cell lethality, inhibited the capacity of crypt cells to repair sublethal radiation damage. In addition, heat applied either before or after single radiation exposures potentiated lethal damage to crypt cells; the degree of enhancement was dependent on the time interval between treatments. At the levels of heating employed, DNA synthesis in the intestinal epithelium was significantly reduced immediately following exposure, but returned rapidly to normal levels. No further disturbances in cellular kinetics were observed for up to 10 days after heating. Author

N79-10732*# Medical Coll. of Virginia, Richmond.

A MICROANGIOGRAPHIC STUDY OF THE EFFECT OF HYPERTHERMIA ON THE RABBIT BLADDER

S-O. Hietala, Robert Howells, and I. A. Hazra *In* NASA. Langley Res. Center Hyperthermia as an Antineoplastic Treatment Modality 1978 p 45-51 refs (For primary document see N79-10728 01-52)
Avail: NTIS HC A05/MF A01 CSCL 06E

A model was used to study the effect of hyperthermia on a normal tissue. The model selected was the rabbit bladder and the end point measured was the changes in the micro-vasculature of the bladder wall. It was already demonstrated clinically that hot water bladder infusions produce regression in bladder tumors. G.G.

N79-10733*# Medical Coll. of Virginia, Richmond.

THE COMBINED EFFECTS OF PULSED MAGNETIC RADIATION (DIAPULSE) AND CHEMOTHERAPY ON TUMOR BEARING MICE. THE MEASUREMENT OF RODENT PALATAL EXPLANTS AS A DEVICE FOR MEASUREMENT OF THE BIOLOGIC EFFECTS OF NONIONIC RADIATION (EMR)

Williamson Regelson, Brian West, and Dominick P. DePaola (Fairleigh Dickinson Univ.) *In* NASA. Langley Res. Center Hyperthermia as an Antineoplastic Treatment Modality 1978 p 53-66 refs (For primary document see N79-10728 01-52)
Avail: NTIS HC A05/MF A01 CSCL 06R

Simultaneous treatment utilizing pulsed radiowave and cancer chemotherapy significantly extended the life span of mice with Lewis lung transplanted carcinoma. In comparison with nontreated controls, the combination of hydroxyurea and whole body nonionizing EM radiation (at 27.12 MHz) produced differential enhancement of longevity depending on hydroxyurea combined with highest power output achieved by pulsing the radiation 600 times per second; at a 3.9% duty cycle, peak watts = 975 produced the mean extension of life 67% greater than that of the group treated with hydroxyurea alone. G.G.

N79-10734# Albert Einstein Coll. of Medicine, New York. Dept. of Pathology.

MORPHOLOGICAL AND BIOCHEMICAL EFFECTS OF OXYGEN TOXICITY Final Report, 1 Apr. 1968 - 30 Nov. 1976

Robert M. Rosenbaum and Murray Wittner 1 Mar. 1978 49 p refs
(Contract N00014-75-C-0223)
(AD-A056778) Avail: NTIS HC A03/MF A01 CSCL 06/3

Morphologic and biochemical studies dealing with effects of high O2 concentrations were made on a wide range of cell types including protozoa, mammalian cell lines, lung cells and marine invertebrate and amphibian eggs. Studies were aimed at evaluating effects O2 on proteolysis of cells, on mitoses, on DNA, RNA and protein synthesis, on the etiology of alveolar lining cell injury, and on the development of O2 tolerance in rats. Peripheral areas related to these studies dealt with the demonstration of different subgroups of the same family of some acid hydrolases and effects of O2 on the two pathways of serotonin metabolism. Ultrastructural studies stressed the conformational changes of mitochondria in type 2 cells of tolerant rats and sequence of O2 induced injury at the level of terminal airway. Author (GRA)

N79-10735# California Univ., Livermore. Lawrence Livermore Lab.

NEW DEVELOPMENTS IN ULTRASONIC IMAGING OF THE CHEST AND OTHER BODY ORGANS

G. W. Campbell and A. L. Anderson 27 Apr. 1978 26 p refs Presented at the IAEA Symp. on Advan. in Radiation Protec. Monitoring, Stockholm, 26-30 Jun. 1978
(Contract W-7405-eng-48)
(UCRL-80340-rev-1; Conf-780612-3; IAEA-SM-229/SM) Avail: NTIS HC A03/MF A01

The ultrasonic imaging system described measures chest-wall thickness and the percentage of fat in the chest and around other body organs. The system uses pulse-echo techniques to transmit and detect sound waves reflected from the interfaces of body organs and adjacent tissue. A computer draws these interfaces on color scans, and a code is used to exponentially average data from several points on each scan to find the average thicknesses of the chest wall and fat layers. These average thicknesses are then used to adjust X-ray calibration factors for plutonium lung counters. The correction factor for three subjects measured for fat content ranging from 12.6 to 22.2% was 18 to 41%. The ultrasonic system also defines the shape and position of the kidneys and liver so we are able to more accurately place detectors on the body during in-vivo radiation measurements. DOE

N79-10736# National Technical Information Service, Springfield, Va.

BIOCOMPATIBLE MATERIALS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Jun. 1978

Pernell W. Crockett Jul. 1978 263 p Supersedes NTIS/PS-77/0615; NTIS/PS-76-0537; NTIS/PS-75/488; COM-74-11126 (NTIS/PS-78/0675/5; NTIS/PS-77/0615; NTIS/PS-76/0537; NTIS/PS-75/488; COM-74-11126) Avail: NTIS HC $28.00/MF $28.00 CSCL 06L

The fabrication and preparation of biomaterials and the evaluation of the compatibility of the materials to tissues and blood components in vivo and in vitro tests is reviewed. The utilization in mechanical organs, prosthetic devices, implants, and surgical materials is discussed. This bibliography contains 257 abstracts. GRA

N79-10699# Joint Publications Research Service, Arlington, Va.

NEUROPHYSIOLOGICAL BASES OF VESTIBULAR CONDITIONING

G. I. Gorgiladze *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 1-13 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 3-11 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

N79-10707# Joint Publications Research Service, Arlington, Va.

ANALYSIS OF DISTRIBUTION OF SEQUENCES OF R-R INTERVALS IN ASTRONAUTS: GENERALIZED COORDINATE METHOD

Yu. M. Svirezhev, N. I. Vikhrov, and V. I. Kozharinov *In its*

Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 53-57 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 39-43 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

N79-10708# Joint Publications Research Service, Arlington, Va.
COMPENSATORY REACTIONS OF THE KIDNEYS TO ORTHOSTATIC FACTORS
Ye. A. Ilin, V. I. Korolkov, K. V. Stelingovskiy, E. V. Tyurina, V. P. Berezov, and V. F. Zenin *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 58-62 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 43-46 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

N79-10709# Joint Publications Research Service, Arlington, Va.
CLINICAL AND MORPHOLOGICAL STUDIES OF PEOPLE IN THE COURSE OF LONG-TERM HYPOKINESIA AND SUBSEQUENT READAPTATION
V. P. Dygin, V. A. Maksimov, V. G. Shubin, N. T. Sverdlina, and N. M. Leshchenko *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 63-67 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 46-50 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

N79-10710# Joint Publications Research Service, Arlington, Va.
CARDIAC ARRHYTHMIA FOLLOWING POSTIMMERSION +G SUB z ACCELERATIONS
I. F. Vil-Vilyams and Ye. B. Shulzhenko *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 68-75 refs Trans. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 50-56 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

N79-10713# Joint Publications Research Service, Arlington, Va.
EFFECTS OF ENDOGENOUS FACTORS ON THE PROCESS OF GAS BUBBLE FORMATION IN THE BODY RELATED TO DECOMPRESSION
K. S. Yurova *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72215) 26 Oct. 1978 p 88-93 ref Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 63-67 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

N79-10717# Joint Publications Research Service, Arlington, Va.
A METHOD OF EVALUATING THE PUPILLARY REACTION TO VESTIBULAR STIMULI
E. V. Lapayev, G. I. Pavlov, G. V. Anisimov, O. A. Cherkasov, and M. I. Katalov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 110-116 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 19-82 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

N79-10719# Joint Publications Research Service, Arlington, Va.
EFFECTS OF LONG-TERM AND CHRONIC RADIATION ON HEMOPOIESIS
T. M. Zukhbaya *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 122-125 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 85-86 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N79-10737# Illinois Univ., Savoy. Aviation Research Lab.
JUDGEMENT EVALUATION AND INSTRUCTION IN CIVIL PILOT TRAINING Final Report, Nov. 1976 - Dec. 1977
R. S. Jensen and R. A. Benel Dec. 1977 152 p
(Contract DOT-FA77WA-3920)
(AD-A057440; FAA-RD-78-24) Avail: NTIS HC A08/MF A01 CSCL 05/10

The nature of good flying judgment and its acquisition, development, and evaluation are examined from the perspectives of aviation and psychology. A definition of pilot judgment is presented consisting of an intellective part (How well can you think?) and a motivative part (are you cautious or risky?). Evidence from research in other fields indicates that both aspects of judgement can be taught and evaluated. A broad outline for a judgment training and evaluation program is presented along with techniques to be implemented in ground school and aircraft training. A.R.H.

N79-10738# Naval Training Equipment Center, Orlando, Fla.
COMPENSATION FOR TRANSPORT DELAYS PRODUCED BY COMPUTER IMAGE GENERATION SYSTEMS Final Report, Nov. 1976 - May 1978
G. L. Richard, M. L. Cyrus, D. C. Cox, T. K. Templeton, and L. C. Thompson Jun. 1978 70 p refs Prepared in cooperation with the Air Force Human Resources Lab., Brooks AFB, Tx.
(AD-A056720; NAVTRAEQUIPC-IH-297; AFHRL-TR-78-46)
Avail: NTIS HC A04/MF A01 CSCL 05/9

This report describes a cooperative Navy/Air Force effort aimed at the problem of image-flutter encountered when visual displays that present computer-generated images are used for the simulation of certain flying situations. Two experiments are described that extend laboratory work on delay compensation schemes to the simulation of formation flight in a research device -- the Advanced Simulator for Pilot Training. The scheme used was one where low-pass filters were added to the lead-generation software of the visual display system. Both studies were geared to determining break-points for those filters that would allow adequate flying control performance and provide an acceptable display. These experiments were based on the notion that a trade exists between the suppression of the visual image's flutter and the removal of the low frequency information necessary for flight control. One experiment represented a factorial combination of settings of the display filters and the non-visual cues of aircraft motion provided by the ASPT's g-seat and motion platform, and the second represented a simple comparison of filter settings. Both studies indicated that, at least for formation flight, there is a range of filter settings which will not adversely affect flight control and will adequately suppress visual flutter. This range represents half-power settings for the filters of 3/4 to 1 Hertz. Author (GRA)

N79-10739# Oregon Univ., Eugene. Dept. of Psychology.
TIME-SHARING IS NOT A UNITARY ABILITY
Harold L. Hawkins, Merton Church, and Suzanne deLemos 30 Jun. 1978 46 p refs
(Contract N00014-77-C-0643)
(AD-A056632) Avail: NTIS HC A03/MF A01 CSCL 05/9

The results of the experiments lead to the conclusion that time-sharing is not a single general ability, but rather is dependent upon several more specific, and perhaps independent, processing limitations. These include: (1) an inability early in practice to simultaneously select, or retrieve, multiple responses from memory; (2) a persisting inability to initiate multiple independent responses simultaneously; (3) an inability to process, or at least efficiently process, contiguous inputs from separate modalities owing to the need for a modality-specific attentional focus; and (4) an inability to efficiently process multiple inputs from within the same modality owing to the existence of structural interference. It is suggested that the prediction of performance on complex criterion task combinations such as entailed in piloting or air traffic control requires specification of which of these component

abilities is required by the criterion situations, and the tailoring or predictor tasks based on this specification. GRA

N79-10705# Joint Publications Research Service, Arlington, Va.
RAT BEHAVIOR IN MAZE AFTER FLIGHT ABOARD KOSMOS-690 BIOSATELLITE
N. N. Livshits, Z. I. Apanasenko, M. A. Kuznetsova, and Ye. S. Meyzerov *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 41-46 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 31-35 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N79-10740 California Inst. of Tech., Pasadena.
STEREO 3-D PERCEPTION FOR A ROBOT Ph.D. Thesis
Scott Darrell Roth 1978 125 p
Avail: Univ. Microfilms Order No. 7817471

A stereo snapshot vision theory for a computer is proposed, based on an experimental implementation. A stereopsis algorithm is presented for growing stereo surfaces in natural scenes. First, 2-D features are extracted from the stereo pair of digital images by locating patterns of change in the images gradient-arrow representations. Then, by associating features in the left image with features in the right image, stereo regions or matches are made. The stereopsis process fuses the stereo images by growing contexts of matched features. Every match defines via the camera geometry a visible surface in the scene, interlocking with neighboring matches like the pieces of a 3-D jigsaw puzzle. The resultant surface molds provide a firm basis for a polyhedral model of the scene's forms. Dissert. Abstr.

N79-10741*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
GENERALIZED ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM COMPUTER PROGRAM (G1894), PHASE 3 Final Report
R. E. McEnulty Sep. 1978 23 p refs
(Contract NAS9-14877)
(NASA-CR-151836; MDC-G7699) Avail: NTIS HC A02/MF A01 CSCL 06K

The work performed during Phase 3 of the Generalized Environmental Control Life Support System (ECLSS) Computer Program is reported. Phase 3 of this program covered the period from December 1977 to September 1978. The computerized simulation of the Shuttle Orbiter ECLSS was upgraded in the following areas: (1) the payload loop of the Shuttle simulation was completely recoded and checked out; (2) the Shuttle simulation water and freon loop initialization logic was simplified to permit easier program input for the user; (3) the computerized simulation was modified to accept the WASP subroutine, which is a subroutine to evaluate thermal properties of water and freon; (4) the 1108 operating system was upgraded by LEC; (5) the Shuttle simulation was modified to permit failure cases which simulate zero component flow values; and (6) the Shuttle SEPS version was modified and secure files were setup on the 1108 and 1110 systems to permit simulation runs to be made from remote terminals. S.E.S.

N79-10742# Hughes Aircraft Co., Culver City, Calif.
A BEHAVIORAL MODEL OF TARGET ACQUISITION IN REALISTIC TERRAIN Final Technical Report, 15 Dec. 1976 - 15 Oct. 1977
L. A. Scanlan and A. K. Agin Jun. 1978 101 p refs Prepared for US Army Electronics Command, Fort Belvoir, Va.
(Contract DAAK70-77-C-0013)
(AD-A056760; HAC-REF-D8983; HAC-P78-70R) Avail: NTIS HC A06/MF A01 CSCL 05/5

The research obtained eye fixation data while searching for targets in both realistic and abstract scenes. A Markov model of target acquisition is proposed and preliminary tests of its adequacy are made using the eye fixation data. The model considers the influence of input data, expectation, perceptual processing, and perceived scene information on the target acquisition process and offers considerable promise as a modeling approach. Author (GRA)

N79-10743# Naval Postgraduate School, Monterey, Calif.
HUMAN FACTORS EVALUATION OF THE AN/UYQ-21 DISPLAY CONSOLE M.S. Thesis
Thomas Edward Klocek Mar. 1978 63 p refs
(AD-A056383) Avail: NTIS HC A04/MF A01 CSCL 09/5

This paper analyses the AN/UYQ-21 display console from a human factors standpoint. The AN/UYQ-21 is programmed for use in NTDS, acoustics displays and can have fire control applications. The paper is organized so that the current threat and the Naval Tactical Data System are discussed briefly in the introduction. A general discussion of man as a system component follows along with a description of the AN/UYQ-21. The man-machine engineering aspects of the console are discussed at length including controls, display, viewing angles, maintainability, symbology and physical dimension. The paper concludes with comments and recommendations for improvememt on this and follow-on systems. Author (GRA)

N79-10744# Army Construction Engineering Research Lab., Champaign, Ill.
ESTABLISHING HABITABILITY FACTORS FOR THE DESIGN OF OFFICE ENVIRONMENTS
Charles C. Lozar Jun. 1978 14 p refs
(AD-A056463) Avail: NTIS HC A02/MF A01 CSCL 05/5

The purpose of this presentation is to document an overall methodology which incorporates experimental design considerations from the social sciences, specifically environmental psychology, and transfers that technology to planning and design application to improve habitability in office environments. The importance of this application is that the habitability factors which are involved in most office environments do not have a firm basis in basic research, and are not well documented in terms of guidance information for designers. This paper will present a discussion of a means of derivation for habitability factors in a particular context of office environments. However, the same methodology will be shown to be applicable to other types of environments, with the process being beneficial to the generation of new basic research, application of new concepts, and continuing accumulation of new knowledge in the area of habitability factors for any environment. GRA

N79-10711# Joint Publications Research Service, Arlington, Va.
EFFECTS OF VIBRATION AND NOISE ON SOME INDICES OF EFFICIENCY OF MI-4 HELICOPTER CREWS
Yu. N. Kamenskiy and Ye. A. Sokolova *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 76-81 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 56-59 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

N79-10716# Joint Publications Research Service, Arlington, Va.
DECREASED ACTIVITY OF PALLADIUM CATALYST DURING PROCESSING OF EXCRETA
G. S. Dinyak and L. A. Margolis *In its* Space Biol. and Aerospace Med., Vol. 12, No. 5, 1978 (JPRS-72115) 26 Oct. 1978 p 106-109 refs Transl. into ENGLISH from Kosm. Biol. i Aviakosm. Med. (Moscow), no. 5, 1978 p 76-78 (For primary document see N79-10698 01-51)
Avail: NTIS HC A06/MF A01

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N79-10745 Duke Univ., Durham, N. C.
DYNAMIC FILE ALLOCATION IN A DISTRIBUTED DATA-BASE SYSTEM Ph.D. Thesis
Jamed Edward Ames, IV 1977 94 p
Avail: Univ. Microfilms Order No. 7815655

A fundamental question of the dynamic file assignment problem is when to reassign the files. Presented are results of experiments designed to show the effect of different scheduling policies in the file assignment problem. The methodology for analyzing a real system with regard to the dynamic file assignment problem is also given. Finally, an algorithm which formalizes the process of dynamically distributing the files is discussed in detail. An event driven simulation model is developed for a hospital information system. The information needed by the parameterization process was gathered by a software monitor. The model was verified by comparing the results of the simulation to the results of an analytic model for three test systems. Validation is performed by comparing the results of the simulation to the performance measures collected directly from the actual information system. Dissert. Abstr.

N79-10746 Rochester Univ., N. Y.
DOUBLES OF MANIFOLDS Ph.D. Thesis
Lawrence Allen Ray 1978 74 p
Avail: Univ. Microfilms Order No. 7815301

The concept of a double manifold is generally used when studying manifolds with boundary as a means to obtain a manifold without boundary. From the analysis it can be concluded that sphere-covered manifolds are not double manifolds and that the first homology group may give an important algebraic invariant in the determination if a manifold is a double manifold.
Dissert. Abstr.

N79-10747 Case Western Reserve Univ., Cleveland, Ohio.
A SOFTWARE-GENERATED INTERFACE FOR CONNECTING INDEPENDENT CONTINUOUS SYSTEM SIMULATORS Ph.D. Thesis
James H. Miller 1978 209 p
Avail: Univ. Microfilms Order No. 7816476

An interface was constructed which permits the connection of independent dynamic simulators to each other and to MIMIC and CSMP. A language for describing these connections was written, and a translator which uses such a description to generate an interface for the described network, was implemented.
Dissert. Abstr.

N79-10748 Texas Univ. at Austin.
CONFIGURATION OF DISTRIBUTED DATA BASE SYSTEMS WITH TREE TOPOLOGIES Ph.D. Thesis
Randolph Tzu-yu Yeh 1978 215 p
Avail: Univ. Microfilms Order No. 7817736

An overview of distributed data base systems is first presented. Mathematical models for distributed systems are then classified and briefly discussed. A design methodology for distributed systems is suggested with an emphasis on a structured methodology and the use of models. Various design problems are defined and investigated; these include the optimal assignment of computing capacities, data base locations, and line capacities in two-level and multi-level star topology distributed systems; the design of two-level and multi-level distributed data base systems with tree topologies; and a case study in which an interactive network design aid package was developed to assist in the design of distributed system for the Department of Mental Health Mental Retardation of the State of Texas. For these problems, either the exact solution is presented, or a good heuristic approach is proposed. Dissert. Abstr.

N79-10749 Yale Univ., New Haven, Conn.
TENTATIVE COMPILATION: A DESIGN FOR AN APL COMPILER Ph.D. Thesis
Terrence Clark Miller 1978 286 p
Avail: Univ. Microfilms Order No. 7819476

A compiler for APL which significantly lowers the cost of APL execution is described. The design includes a notation with which the actions required for the execution of the majority of the APL operators may be expressed. Transformations are applied to the program expressed in this intermediate notation. The transformations re-order independent calculations for a given operation, and intermix calculations for several operations. The intent is to produce an intermediate result only when it is needed (thus avoiding storage) and only if it contributes to the final result (thus eliminating unnecessary calculations). Examples show that significant savings are obtained. Dissert. Abstr.

N79-10750 Yale Univ., New Haven, Conn.
COMPUTATIONAL GEOMETRY Ph.D. Thesis
Michael Ian Shamos 1978 246 p
Avail: Univ. Microfilms Order No. 7819047

A study is presented of the computational aspects of geometry within the framework of analysis of algorithms. It develops the mathematical techniques that are necessary for the design of efficient algorithms and applies them to a wide variety of theoretical and practical problems. Particular attention is given to proving lower bounds on running time and to analyzing the average-case performance of geometric algorithms. The approach taken is to isolate a computational feature that is common to a large class of problems. Among the major new results presented are a convex hull algorithm with expected running time that is linear in the number of input points, and O(N log N) a algorithm for linear programming in two variables (which is superior to the Simplex method), and on O(N log N)algorithm for constructing a minimum spanning tree on a finite set of points in the plane. Dissert. Abstr.

N79-10751 Cornell Univ., Ithaca, N. Y.
MODELS OF STORAGE STRUCTURES AND THE DESIGN OF DATABASE RECORDS BASED UPON A USER CHARACTERIZATION Ph.D. Thesis
Salvatore Tony March, Jr. 1978 301 p
Avail: Univ. Microfilms Order No. 7817867

A methodology to support systems analysts in the design of database systems is developed. Major contributions of the dissertation include: (1) the development of a generalized model of secondary memory management which significantly reduces the effort required to model alternative file organization designs; (2) the development of mathematical programming algorithms capable of determining efficient record segmentations for a wide range of database retrieval activity; and (3) the integration of these results with an existing approach to file organization design methodology capable of solving a large class of database design problems. Dissert. Abstr.

N79-10752# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.

NEW PARALLEL SORTING SCHEMES
F. P. Preparata Jul. 1977 18 p refs
(Contract DAAB07-72-C-0259; Grant NSF MCS-76-17321)
(AD-A056886; R-782; UILU-ENG-77-2229) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper describes a family of parallel sorting algorithms for a multiprocessor system. These algorithms are enumeration sorts and comprise the following phases' count acquisition: the keys are subdivided into subsets and for each key the number of smaller keys (count) in every subset is determined; rank determination: the rank of a key is the sum of the previously obtained counts; data rearrangement: each key is placed in the position specified by its rank. The basic novelty of the algorithms is the use of parallel merging to implement count acquisition.
GRA

N79-10753# Naval Ocean Systems Center, San Diego, Calif.
PSEUDORANDOM NUMBER GENERATOR. PROGRAM-CONTROLLED SOURCE OF THREE 15-BIT RANDOM-NUMBER WORDS PER MICROSECOND FOR AP-120B ARRAY PROCESSORS Technical Document, Mar. - Apr. 1978
W. G. Lafond 1 Jun. 1978 23 p
(AD-A056793; NOSC/TD-163) Avail: NTIS HC A02/MF A01 CSCL 09/2

The objective of this project was to provide AP-120B array processors with a program-controlled source of 15-bit random-number words at the rate of three per microsecond. A simple TTL circuit was implemented to do this. The implementation and testing of a fast algorithm to generate uniformly distributed random numbers is described. The same shift-register method can be expanded to include a fast RAM memory that will provide random numbers of any given distribution without slowing the controlling array-processor program. Author (GRA)

N79-10754# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
RESEARCH IN NATURAL LANGUAGE UNDERSTANDING Quarterly Progress Report, 1 Mar. - 31 May 1978
Bonnie Lynn Webber, R. Bobrow, and William A. Woods Jul. 1978 65 p refs
(Contract N00014-77-C-0378; ARPA Order 3414)
(AD-A056838; BBN-3878; QPR-3) Avail: NTIS HC A04/MF A01 CSCL 05/7

The goals of the project are to develop techniques required for fluent and effective communication between a decision maker and an intelligent computerized display system in the context of complex decision tasks such as military command and control. This problem is approached as a natural language understanding problem, since most of the techniques required would still be necessary for an artificial language designed specifically for the task. Characteristics that are considered important for such communication are the ability for the user to omit details that can be inferred by the system and to express requests in a form that 'comes naturally' without extensive forethought or problem solving. These characteristics lead to the necessity for a language structure that mirrors the user's conceptual model of the task and the equivalents of anaphoric reference, ellipsis, and context-dependent interpretation of requests. These in turn lead to requirements for handling large data bases of general world knowledge to support the necessary inferences. The project is seeking to develop techniques for representing and using real world knowledge in this context, and for combining it efficiently with syntactic and semantic knowledge. This report discusses aspects of research to date and a general approach to definite anaphoric reference and near-deterministic parsing strategies.
GRA

N79-10755# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
MESSAGE TECHNOLOGY RESEARCH AND DEVELOPMENT Quarterly Progress Report, 2 Jan. - 2 Apr. 1978
J. Burchfiel and T. Myer Jul. 1978 17 p
(Contract MDA903-76-C-0212; ARPA Order 3161)
(AD-A056836; BBN-3879; QPR-9) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report describes efforts in the continuing development of the HERMES message-processing system, with respect to system design, security requirements and preparations for the DARPA/NAVY/CINCPAC interactive test. GRA

N79-10756# Harry Diamond Labs., Adelphi, Md.
REAL-TIME AND MEMORY CORRELATION VIA ACOUSTO-OPTIC PROCESSING
Norman J. Berg, John N. Lee, and Burton J. Udelson Jun. 1978 15 p refs
(AD-A056411) Avail: NTIS HC A02/MF A01 CSCL 09/2

The requirements of advanced radar systems, secure communications networks, and signal-warfare concepts place severe strains on the capabilities of presently available analog processing technologies. These applications require real-time processing with large bandwidth and dynamic range. The use of acousto-optic technology as an answer to these requirements appears very attractive. Three fundamental signal-processing schemes using the acousto-optic interaction have been investigated: (1) real-time correlation and convolution, (2) Fourier and discrete Fourier transformation, and (3) programmable memory correlation. By combining previously known techniques with newly discovered phenomena, major advances in analog signal processing have been demonstrated. Time-bandwidth products in excess of 10,000 and linear dynamic ranges in excess of 50 db have been achieved with real-time processors. Using the recently discovered acousto-photorefractive effect, storage of surface-acoustic-wave (SAW) signals in lithium niobate ($LiNbO_3$) has been demonstrated. During the information storage time of up to several months, 'live' signals can be acousto-optically correlated with the stored signals. This storage phenomenon can be used as the basis for a wide variety of new signal-processing architectures. GRA

N79-10757# Develco, Inc., Sunnyvale, Calif.
MAGNETIC BUBBLE MEMORY SYSTEM CONCEPTS FOR FIELD DATA ACQUISITION APPLICATIONS Final Report
L. R. Bulduc, T. C. Moore, O. L. Kwong, and E. P. Hutchins 30 Sep. 1977 159 p
(Contract DNA001-77-C-0137)
(AD-A056391; AD-E300265; Rept-1026-77930; DNA-4499F)
Avail: NTIS HC A08/MF A01 CSCL 09/2

The characteristics of the new solid state, nonvolatile Magnetic Bubble Memories (MBM) were investigated to define their potential for field data acquisition applications. A prototype model of a memory subsystem (hardware and software) was designed and tested to demonstrate one concept. Other memory and acquisition system design alternatives were also considered. Author (GRA)

N79-10758# California Univ., Berkeley. Lawrence Berkeley Lab.
COMPUTER PERFORMANCE MANAGEMENT AT LBL
D. F. Stevens Apr. 1978 38 p refs
(Contract W-7405-eng-48)
(UCID-3994) Avail: NTIS HC A03/MF A01

The approach to five aspects of computer performance management--workload projection, system tuning, behavior modification, information gathering, and service levels--is outlined. Two factors exert considerable influence on the operation of the LBL computer center: the center writes its own operating system when necessary, and the style of computing is entirely open shop. DOE

N79-10759# California Univ., Livermore. Lawrence Livermore Lab.
MULTI-ACCESS STORAGE SUBNETWORK
Donaldson L. Wentz 7 Sep. 1977 20 p refs Presented at ERDA/AESOP 17, Boston, 13-15 Sep. 1977
(Contract W-7405-eng-48)
(UCRL-80053; Conf-770937-1) Avail: NTIS HC A02/MF A01

Characteristics of the Multi-Access Storage Subnetwork (MASS) discussed include an on-line capacity of 1 x 10 to the 12th power bits of user storage and the MASS architecture which provides a very high performance approach to the management of MASS storage, as well as a high degree of reliability needed for operation in a time sharing environment. Key design features include: (1) a data transmission scheme which provides a 40 megabit-per-second channel to link MASS with the worker computer disk systems; (2) a 280 megabit-per-second, 24 port memory multiplexor controlling a large MOS memory used for intermediate buffer between the computers

and the MASS storage; (3) and a set of high speed microprocessor-based controllers driving the commercial MASS storage units. Reliability of the system is provided by a redundant network including two control minicomputer systems, and error detection and correction in the MOS buffer. Integrity of user files transferred via MASS is insured by a 64 bit hardware generated checksum carried with each file throughout the network. DOE

N79-10760# National Technical Information Service, Springfield, Va.
DISTRIBUTED DATA PROCESSING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1978
George W. Reimherr Jul. 1978 90 p Supersedes NTIS/PS-77/0576
(NTIS/PS-78/0671/4; NTIS/PS-77/0576) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The bibliography of Federally-funded research cites studies on the concepts, design, development, implementation, and application of distributed data processing. Research on distributed data bases is included. This updated bibliography contains 84 abstracts, 29 of which are new entries to the previous edition. GRA

N79-10761# National Technical Information Service, Springfield, Va.
DISTRIBUTED DATA PROCESSING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jun. 1978
George W. Reimherr Jul. 1978 141 p Supersedes NTIS/PS-77/0577
(NTIS/PS-78/0672/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The bibliography of worldwide journal literature cites studies on the concepts, design, development, implementation, and application of distributed data processing research on distributed data bases. This updated bibliography contains 134 abstracts, 72 of which are new entries to the previous edition. GRA

N79-10762# Auerbach Associates, Inc., Philadelphia, Pa.
COMPARISON OF TAPE DRIVE INTERFACE CHARACTERISTICS Final Report
15 Jun. 1978 77 p
(Contract NBS-7-35843)
(PB-282291/4; AAI-3024-FR; NBS/GCR-78/127) Avail: NTIS HC A05/MF A01 CSCL 09B

The various characteristics of the interface between computer tape drives and their controllers for 9-track tape drives operating at 75 inches per second or more, using the 800 bpi NRZI, 1600 bpi Phase Encoding, and 6250 bpi Group Coded Recording methods are described. The results of an investigation conducted for the National Bureau of Standards in support of the possible development of a Federal Information Processing Standard for the device level interface are presented. Through textual descriptions and an extensive series of tables, the various functional and interface electrical characteristics of the tape drives are compared. GRA

N79-10763# IBM Federal Systems Div., Bethesda, Md.
COMPUTER SCIENCE AND TECHNOLOGY: CONSIDERATIONS IN THE SELECTION OF SECURITY MEASURES FOR AUTOMATIC DATA PROCESSING SYSTEMS Final Report
Michael J. Orceyre, Robert H. Courtney, Jr. (IBM Corp., Kingston, N. Y.), and Gladys R. Bolotsky, ed. Jun. 1978 37 p refs Prepared in cooperation with NBS, Washington, D.C.
(PB-282511/5; NBS-SP-500-33) Avail: NTIS HC A03/MF A01 CSCL 09B

The methods and techniques for protecting data in an ADP facility and during transmission are introduced. The material is presented as an aid in evaluating and selecting security measures following the identification of existing risks and potential losses via a risk analysis. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N79-10764 Rice Univ., Houston, Tex.
ON THE DESIGN OF IIR DIGITAL FILTERS WITH APPLICATIONS TO MULTIRATE FILTERING Ph.D. Thesis
Horacio Gregorio Martinez 1978 120 p
Avail: Univ. Microfilms Order No. 7814779

A new algorithm for the design of optimum (in the Chebyshev sense) infinite-duration impulse response digital filters is presented. This new technique allows the design of filters with arbitrary passband and stopband characteristics. Several properties of filters with more zeros than poles are discussed. It is also shown how it is possible to obtain efficient filters for sampling rate increase (interpolation) by imposing some constraints to the numerator coefficients. The design and some properties of these new interpolators are discussed. It is also shown how efficient implementations of narrow band filters can be obtained by combining different types of filters and using the techniques of decimation and interpolation. Dissert. Abstr.

N79-10765 Southern Methodist Univ., Dallas, Tex.
A PROGRAMMING LANGUAGE MODEL FOR AN OPERAND STATE SAVING COMPUTER Ph.D. Thesis
John Bowman Harvill, Jr. 1978 209 p
Avail: Univ. Microfilms Order No. 7819253

A major disability of the current-state von Neumann computer is discussed along with the psychological, physiological, and linguistic justification for an operand-state-saving computer. Notation is developed for naming the past states of the program's operands and programming language syntax is developed for accessing these past values. The accessing qualifiers are very similar to those of natural language. Past and future tense programming verbs are developed for the Programming Language Model. The effort required to create programs using the Programming Language Model is calculated and shown to be favorable when compared with the effort required for the creation of the same programs in a typical current high level language. Aspects of practical implementation of the Programming Language Model are discussed along with the advantages and possible application of such a language. Dissert. Abstr.

N79-10766 New York Univ., N. Y.
CONFIGURABLE SOFTWARE FOR SATELLITE GRAPHICS Ph.D. Thesis
Peter David Hartzman 1978 190 p
Avail: Univ. Microfilms Order No. 7818424

The software was developed for a distributed graphics system in which a minicomputer and a powerful large computer share the work. The design of the system was done at a very high level using the set theoretic language SETL for specifications. The high level specification produced a compact, machine independent virtual graphics data structure for picture representation. A possible extension of the structure for hidden line removal is presented. The software was written in LITTLE, a systems implementation language. This means that only one set of programs is needed for both machines. A user can program both machines in a single language. It also means that most of the software is transportable to machines with available LITTLE compilers. Tests of the system with an application program indicate that it has very high potential. Dissert. Abstr.

N79-10767 California Univ., San Diego.
ALGORITHMIC SOLUTION OF TWO COMBINATORIAL PROBLEMS Ph.D. Thesis
Frank Ruskey 1978 92 p
Avail: Univ. Microfilms Order No. 7819095

The problem of generating all binary trees of a fixed size in some natural order is studied. A ranking algorithm is derived for determining the position occupied by a given tree in the list. An unranking algorithm is presented for producing the tree occupying a given position. The circular cut problem is introduced. Let N be a network with weights attached to both the arcs and nodes. Let v be a distinguished node and M a given constant. The circular cut problem is to find a minimum cut such that the

sum of the weights of the nodes on the same side of the cut as v is less than M. Dissert. Abstr.

N79-10768 Columbia Univ., New York.
CONTEXTUAL REFERENCE RESOLUTION IN NATURAL LANGUAGE PROCESSING Ph.D. Thesis
Abe David Lockman 1978 253 p
Avail: Univ. Microfilms Order No. 7819383

Contextual reference is defined in this work as that set of relations between items in the interpretation of a sentence and items in the interpretation of the sentence's previous text which are normally recovered by a reader through the proper application of the previous text as a context. Thus, this set constitutes the portion of a text's meaning that is more than the sum of the meanings of its individual sentences taken in isolation. Various effects of sentence syntax and inter-sentence text structure are noted, effects whose existence requires the maintenance of a dynamic context structure for resolution. Basic requirements for successful resolution algorithm are deduced, and previous work on the problem is analyzed in terms of these requirements.
Dissert. Abstr.

N79-10769 Columbia Univ., New York.
ANALYSIS OF A NEW METHOD FOR MICROPROCESSOR SOLUTION OF DIFFERENTIAL EQUATIONS Ph.D. Thesis
Dan Ioan Moldovan 1978 225 p
Avail: Univ. Microfilms Order No. 7819398

A numerical method for differential equation solution was designed especially for real-time implementation on small computers. The approach to the differential equation solution is to compute accurately the phase-plane trajectory, while simultaneously integrating time along this trajectory. Special properties of the auxiliary function are demonstrated which will allow the computation of the solution to be based only on additions and logical operations, even for nonlinear systems. A mathematical tool called bounded integer arithmetic (BIA) developed to study the limits on the accuracy of solution as a function of computer resources. Examination of the auxiliary function in the context of BIA leads to an algorithm implementing the new approach. A computer program structured on this algorithm developed for an Intel 8080 based microcomputer. Dissert. Abstr.

N79-10770# Army Engineer Topographic Labs., Fort Belvoir, Va.
AN EXPERIMENTAL DIGITAL INTERACTIVE FACILITY
Lawrence A. Gambino Jun. 1978 15 p refs
(AD-A056438) Avail: NTIS HC A02/MF A01 CSCL 09/2

The U.S. Army Engineer Topographic Laboratories (USAETL), Fort Belvoir, Virginia, has developed an extensive, interactive digital image processing facility to efficiently conduct research in areas such as military intelligence, digital product generation for weapon systems, and digital mapping. The facility is called the Digital Image Analysis Laboratory (DIAL), and it began to evolve from a general purpose computer-oriented system approximately 4 years ago. It is supported by the Defense Mapping Agency (DMA), the Corp of Engineers, and DARCOM's Army Space Program Office (ASPO). The research effort in digital image processing began in a modern computer environment 6 years ago. As experience was gained, it became apparent that it was impractical to produce digital products in this environment because of the computer's inefficiency relative to existing production equipment using electro-optical technology. A classic example of this in the mapping sciences is seen in the development of stereocompilation equipment during the past 20 years where the computer is never used to perform the basic correlation function. GRA

N79-10771# System Development Corp., McLean, Va.
A METHODOLOGY FOR EVALUATING LANGUAGES AND THEIR COMPILERS FOR SECURE APPLICATIONS
Erwin Book, Paul Eggert, and Robert Uzgalis 31 Jan. 1978 52 p refs
(Contract DCA100-73-C-0035)
(AD-A056933; SDS-TM-WD-7909/000/01; CCTC-TM-171-78) Avail: NTIS HC A04/MF A01 CSCL 09/2

This technical memorandum proposes a methodology for the evaluation of Higher Order Programming Languages and their compilers that are to be used in the development of trusted software for secure application. The basic language issues identified are portable software, storage management, input-output, and exceptional conditions and handling. Two general techniques for resolving these issues are identified: (1) avoidance techniques whereby a language design avoids the issue, and (2) automatic techniques in which the compiler or its run system help resolve the issue. The automatic techniques fall into three categories: (1) confinement techniques, which prevent a program from employing its underlying machine in such a way that the machine would not legally implement the language; (2) predictive techniques, which infer some property of a program before it runs on any input data, and (3) automated debugging techniques, such as test data generation and debugging output. The report concludes with the use of the evaluation criteria on three language implementations, PL/1, ALGOL 68, and PASCAL, for their resolution of the storage management issues.
Author (GRA)

N79-10772# Colorado Univ. at Boulder. Dept. of Computer Science.
THE FSCAN LEXICAL ANALYZER GENERATING SYSTEM Interim Technical Report
Geoffrey Clemm Jun. 1978 20 p refs
(Grants DAAG29-78-G-0046; NSF MCS-77-02194)
(AD-A056821; CU-CS-128-78; ARO-15074.3-M) Avail: NTIS HC A02/MF A01 CSCL 09/2

There has recently been much interest in the development of software validation tools for FORTRAN. Such tools are usually designed to analyze programs written in ANSI standard FORTRAN. However, because there are many dialects and extensions of FORTRAN in use, it would be desirable to analyze these as well. One solution is to develop a single diagnostic tool for standard FORTRAN which may be easily modified to accept variants of the language. Since most of the variations occur at lexical and syntactic levels, the design of a flexible lexical analyzer is a key issue. The FSCAN Lexical Analyzer Generating System has been designed with this purpose in mind. This report describes the FSCAN language, a compiler for the language, and an interpreter for the resulting object code. An example of a complete FSCAN program is included. Author (GRA)

N79-10773# Xerox Corp., Palo Alto, Calif.
RESEARCH ON INTERLISP AND NETWORK-BASED SYSTEMS Final Report, 1 Jul. 1977 - 31 Mar. 1978
W. Teitelman 24 May 1978 4 p
(Contract N00014-77-C-0277)
(AD-A056579) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report covers a variety of activities and services centering around the continued growth and well-being of Interlisp, a large interactive system widely used in the ARPA Community for developing advanced and sophisticated computer-based systems. GRA

N79-10774# Los Alamos Scientific Lab., N. Mex.
USE OF COMPUTERS IN MOLD DESIGN
Robert E. Keenan, Jr. and William C. Erickson Jun. 1978 14 p refs
(AD-A056453) Avail: NTIS HC A02/MF A01 CSCL 13/8

This paper presents efforts to determine a system to evaluate mold designs using computer simulations. Although the report describes the mold design for a thin-walled uranium hemisphere, the system is applicable to virtually any shape mold. GRA

N79-10775# Mitre Corp., Bedford, Mass.
SOFTWARE DESIGN METHODOLOGIES AND AIR FORCE SOFTWARE ACQUISITION ENVIRONMENT
D. L. James Jun. 1978 123 p refs
(Contract F19628-77-C-0001)
(AD-A056771; MTR-3508; ESD-TR-78-147) Avail: NTIS HC A06/MF A01 CSCL 09/2

The general goal of the subtask was to explore the ease of transfer of technology on software design methodologies to the Air Force software acquisition environment by studying two methodologies selected by RADC, comparing them with the acquisition environment, and discussing them with acquisition personnel. The two methodologies (one by SRI and one by Honeywell, Inc.) are described with examples. The assumed acquisition environment is described and compared with the

methodologies. The presentations to acquisition personnel are described. Their views as well as those of Project 522M personnel on application of the methodologies are discussed. GRA

N79-10776# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.
PARALLEL ALGORITHMS FOR GRAPH THEORETIC PROBLEMS
Carla Diane Savage Aug. 1977 135 p refs
(Contract DAAB07-72-C-0259; Grant NSF MCS-76-17321)
(AD-A056888; R-784; UILU-ENG-77-2231) Avail: NTIS HC A07/MF A01 CSCL 09/2

The existence of parallel computers has motivated the development of parallel problems solving techniques for many problems. Techniques are studied for solving graph problems on an unbounded parallel model of computation. It is shown that solutions to graph problems can be organized to reveal a large amount of parallelism, which can be exploited to substantially reduce the computation time. Precisely, for an appropriate measure of time complexity, algorithms of time complexity 0 log-squared n are developed to solve each of the following problems for graphs with n vertices: finding minimum spanning trees, biconnected components, dominators, bridges, cycles, cycle bases, and shortest cycles. The number of processors needed to execute each algorithm is bounded above by a polynomial function of n. It is shown that 2 log n - c is a lower bound on the time required to solve each of these graph problems. Thus, the algorithms obtained have time complexities which are optimal to within a factor of log n. GRA

N79-10777# Colorado Univ., Boulder. Dept. of Computer Science.
AN LALR(1) PARSER GRAMMAR FOR FORTRAN Interim Technical Report
Russ C. Rauhauser Jun. 1978 63 p refs
(Grant DAAG29-78-G-0046; NSF MCS-77-02194)
(AD-A056839; CU-CS-129-78) Avail: NTIS HC A04/MF A01 CSCL 09/2

An automatic parser generator is a tool for quickly implementing programming language parsers. Parser generators based upon LR parsing have been built for grammars satisfying the LR(o), SLR(1), and LALR(1) properties. Speed of the resulting parser is comparable to that of a hand coded recursive descent parser. DAVE, an automatic program testing aid, requires a flexible, easy-to-implement parser. This report presents an LALR(1) grammar for ANSI standard FORTRAN, suitable as input to an automatic parser generator. Its use in building DAVE provides a measure of the desired flexibility, since new parsers for FORTRAN dialects may be produced by simply modifying the existing grammar. A powerful meta-language is used to describe the grammar. Its features are summarized, including the method for specifying automatic construction of (intermediate-text) structure trees during parsing. The report concludes with a discussion of some of the more important decisions made during development of the grammar. Author (GRA)

N79-10778# IBM Research Lab., Yorktown Heights N. Y.
STARCAT, A SYSTEM TO ANALYZE INTERACTIVE CMS PERFORMANCE
Roger C. Evans and Lance A. Miller 1978 29 p
(Contract N00014-72-C-0419)
(AD-A056835; RC-7072) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper describes a software system named STARCAT - for STream Analysis of Responses by CATegory. The system analyzes sequences of user command strings that have been captures in a special timestamped CMS console file: user response times, URTs, and system response times, SRTs, are associated with each string; strings are assigned - by command name, environment, or experimenter-chosen groupings - into categories; and category statistics are reported for one, two, and three-string subsequences. STARCAT provides a new tool, valuable to various interface and system design studies, for the quantitative analysis of interactive terminal performance. Author (GRA)

N79-10779# Colorado Univ., Boulder. Dept. of Computer Science.
SOME ALGORITHMS FOR THE ANALYSIS OF COMPUTER PROGRAMS Interim Technical Report
Lloyd D. Fosdick Apr. 1978 32 p refs
(Grant DAAG29-78-G-0046; NSF MCS-77-02194)
(AD-A056820; CU-CS-126-78; ARO-15074.4-M) Avail: NTIS HC A03/MF A01 CSCL 09/2

The analysis of computer programs is an important part of program translation, error detection, optimization, and documentation. It consists of two distinct activities: the construction of an abstract model of a program, given the program itself in some language such as FORTRAN, and the extraction of information from the program by examination of the model. A labeled, directed graph is a model that is often used. In recent years workers in theoretical computer science have constructed and analyzed algorithms for solving problems on labeled, directed graphs which are directly related to important problems arising in the analysis of computer programs. Some of these algorithms and their applications are described. The discussion does not assume a knowledge of graph theory. Author (GRA)

N79-10780# RAND Corp., Santa Monica, Calif.
MODIA. VOLUME 3: OPERATION AND DESIGN OF THE USER INTERFACE, APPENDIX
Polly Carpenter-Huffman, Misako Fujisaki, and Ray Pyles Apr. 1978 44 p
(Contract F49620-77-C-0023)
(AD-A057076; RAND/R-1702/1-AF) Avail: NTIS HC A03/MF A01 CSCL 09/2

A description of the User Interface (UI) program of MODIA (a Method of Designing Instructional Alternatives) is presented for readers responsible for maintaining, modifying, or transporting that program to another computer system. It is technical in content, and we assume that the reader is familiar with program operation as described in the text of this report. GRA

N79-10781# Sandia Labs., Albuquerque, N. Mex.
STORAGE REDUCTION FOR RUNGE-KUTTA CODES
L. F. Shampine May 1978 12 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0909) Avail: NTIS HC A02/MF A01

Three techniques of increasing generality for reducing storage requirements of Runge-Kutta codes are described. Although the first two require the formula to have special properties, they are broadly applicable and may substantially reduce the storage without any extra operations and without any real complication of the code. The last technique affords a substantial reduction in storage if the number of stages is moderate to large. There are no extra arithmetic operations, but there is a small penalty in overhead because of some swapping in memory. The techniques may be combined. A few illustrative examples of practical importance are given. DOE

N79-10782# Sandia Labs., Albuquerque, N. Mex.
CODES FOR DIJKSTRA'S SHORTEST PATH ALGORITHM
B. L. Hulme and J. A. Wisniewski Apr. 1978 35 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0493) Avail: NTIS HC A03/MF A01

A users guide to three subroutines for finding shortest paths in a graph is presented. The three codes, DKSTR, SDKSTR, and USDKST, all implement Dijkstra's method as modified by Yen. They differ in their data structures, since DKSTR is intended for general use, while SDKSTR is intended for sparse graphs. Because of its speed and its potential for great storage savings in applied problems where the graphs tend to be large and sparse, SDKSTR is seen to be the most useful of these codes. DOE

N79-10783# California Univ., Livermore. Lawrence Livermore Lab.
CAIN SOFTWARE SYSTEM
D. Neilson 11 Nov. 1977 33 p
(Contract W-7405-eng-48)
(UCID-17671) Avail: NTIS HC A03/MF A01

The Computer Access by Individual Number (CAIN) personnel security-access system is discussed. The system uses a coded insert in a laminated personnel badge. A number of badge readers are attached to the system by secure lines. The readers are used by the system for control of access booths, perimeter off-hours logging, and file modification. Each reader has the ability of transmitting additional parameters, such as an individual's

numeric combination code and his weight. The software uses a fixed head disc for the system files. The program is core resident with the booth-access and logging processes executed as interrupt-driven procedures. The system allows entry, verification and change of access files via a number of input terminals. DOE

N79-10784# Stuttgart Univ. (West Germany). Inst. fuer Informatik.
IMPLEMENTATION AND PERFORMANCE COMPARISON FOR A MICROPROGRAMMED HIERARCHICAL OPERATING SYSTEM NUCLEUS Interim Report
Walter H. Burkhardt and Helmut E. Maier May 1978 25 p refs
(PB-282612/1; USTG-INF-BU-78-01) Avail: NTIS HC A02/MF A01 CSCL 09B

Gains in efficiency are arrived from microprogramming single functions of operating systems (OS). An OS nucleus was designed and implemented on several levels of the firmware-software hierarchy. The main characteristics is functional equivalence as a basis for performance comparisons. The layer concept of modern OS permitted optimization on a micro storage hierarchy. A special firmware/software monitor measured the performance of each implementation. The results demonstrate significant reductions of OS-overhead for the microprogrammed OS-nucleus. The reductions amount to between one half to one and a half order of magnitude. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N79-10785 Polytechnic Inst. of New York.
ON THE ANALYSIS AND DESIGN OF NETWORKS USING INTELLIGENT PROCESSORS Ph.D. Thesis
Shneor Brutzkus 1978 135 p
Avail: Univ. Microfilms Order No. 7816743

In computer communication networks, information is transferred in the form of messages, which may be subdivided into packets. The elimination of addressing information is achieved by transmitting information between nodes in frames. Approximate techniques and models for analyzing and designing networks using this kind of processor are developed. A comparison between the performance of a network using intelligent processors with that of a packet-switched network is given, and shown improvements in the time delay, especially for high utilization. Dissert. Abstr.

N79-10786 Texas A&M Univ., College Station.
OPTIMAL ROUTING WITHIN LARGE SCALE DISTRIBUTED COMPUTER-COMMUNICATIONS NETWORKS Ph.D. Thesis
William Howard Greene 1978 222 p
Avail: Univ. Microfilms Order No. 7817178

Routing algorithms which function relatively independent of storage and bandwidth and are therefore adaptable to any size network are discussed. A relatively simple method for routing messages across large scale networks employs a heuristic searching mechanism which requires that a network be described as a graph using the root-node-leaf notation. The level of the tree is equivalent to the known delay about a network at any particular node. The algorithm searches the tree down each leg, evaluating the path from each leaf to the destination node using heuristic information to determine the optimum path. This approach is combined with the classical decomposition-synthesis network evaluation technique to derive a formula for delay. Several heuristic measures applicable to this formula are evaluated by the simulator. Dissert. Abstr.

N79-10787 Princeton Univ., N. J.
ON REDUCTIONS AND LIVELOCKS IN ASYNCHRONOUS PARALLEL COMPUTATION Ph.D. Thesis
Yat Sang Kwong 1978 181 p
Avail: Univ. Microfilms Order No. 7818369

Intuitive reduction for parallel programs is presented in the framework of asynchronous systems. A simple and general class of reductions is given by establishing sufficient conditions under which many correctness properties are preserved, including the absence of deadlocks, determinancy, homing, and the Church-Rosser property. Livelocks are classified into two types according to their causes of formation. Two techniques for proving the absence of livelocks are presented. Dissert. Abstr.

N79-10788# Stanford Univ., Calif. Digital Systems Lab.
A STRUCTURAL DESIGN AUTOMATION ENVIRONMENT FOR DIGITAL SYSTEMS
W. M. VanCleemput Dec. 1977 27 p refs
(Contracts N00014-75-C-0601; DASG60-77-C-0073)
(AD-A056817; SU-DSL-TN-134) Avail: NTIS HC A03/MF A01 CSCL 09/2

This paper describes a design automation system for digital systems that promotes a structured design approach both in logic design phase and in the physical implementation phase. Author (GRA)

N79-10789# California Univ., Livermore. Lawrence Livermore Lab.
DATA DIRECTOR SYSTEM MANUAL
P. R. McGoldrick and D. N. Butner 16 Mar. 1978 155 p refs
(Contract W-7405-eng-48)
(UCID-17749) Avail: NTIS HC A08/MF A01

The Data Director is a multi-user timesharing computer system which allows file manipulation (i.e., editing, printing, punching, etc.) and file transport between it and the OCTOPUS computer system. The heart of the Data Director is an Interdata 7/16 HSALU mini-computer with a 10-Megabyte disk. Data Director users use 9600 baud CRT terminals to interact with the Data Director. The main purposes of the Data Director are to provide a fast, stable, and reliable system for editing and to provide remote punching of files. DOE

N79-10790# National Technical Information Service, Springfield, Va.
COMPUTER NETWORKS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1975 - Jul. 1977
David W. Grooms Aug. 1978 324 p
(NTIS/PS-78/0877/7) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The bibliography cites research reports on aspects of computer networks, including hardware, software, data transmission, time sharing, and applicable theory to network design. Specific studies on the ARPA network, the ALOHA system, the GLOBNET system, the OCTOPUS network, the TENEX system, the AUTOVON system, the PLATO system, distributed networks, and other such systems are cited. This updated bibliography contains 317 abstracts, none of which are new entries to the previous edition. GRA

N79-10791# National Technical Information Service, Springfield, Va.
COMPUTER NETWORKS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Aug. 1977 - Jul. 1978
George W. Reimherr Aug. 1978 166 p Supersedes NTIS/PS-77/0728; NTIS/PS-76/0632; NTIS/PS-75/524
(NTIS/PS-78/0878/5; NTIS/PS-77/0728; NTIS/PS-76/0632; NTIS/PS-75/524) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The bibliography cites research reports on aspects of computer networks, including hardware, software, data transmission, time sharing, and applicable theory to network design. Specific studies on the ARPA network, the OCTOPUS network, the TENEX system, distributed networks, and other such systems are cited. This updated bibliography contains 159 abstracts, all of which are new entries to the previous edition. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N79-10792 Princeton Univ., N. J.
AN ADAPTIVE METHOD FOR THE EVALUATION OF MANUAL CONTROL SYSTEMS Ph.D. Thesis
Pershing Bit-Sing Sun 1978 231 p
Avail: Univ. Microfilms Order No. 7818358

It is shown theoretically that optimal task performance is automatically obtained when the adaptive procedure is properly implemented. The concept of Performance Workload is also introduced. Under the assumption of a strictly monotonic functional relationship between the operator's workload and task performance, the optimal task performance achieved under the adaptive method also represents the condition of maximum performance workload. This particular adaptive methodology is applied to the evaluation of a multiaxis tracking task with simple controlled element dynamics. The experimental results are then examined through the construction of an optimal pilot model. The practicality of this approach is further demonstrated in a full-scale simulation tradeoff study among display and automatic feedback augmentation parameters of a UH-1 helicopter at hover.
Dissert. Abstr.

N79-10793# Wisconsin Univ. - Madison.
STATISTICAL ANALYSIS OF THE OUTPUT DATA FROM TERMINATING SIMULATIONS Dept. of Industrial Engineering.
Averill M. Law Apr. 1978 35 p
(Contract N00014-76-C-0403; NR Proj. 047-145)
(AD-A056722; TR-78-4) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper precisely defines the two types of simulations (terminating and steady-state) with regard to analysis of simulation output and discuss some common measures of performance for each type. It is also concluded that a significant proportion of simulations in the real world are of the terminating type. This is contrary to the impression one gets from reading the simulation literature, where the steady-state case is almost exclusively considered. Although analyses of terminating simulations are considerably easier than are those of steady-state simulations, they have not received a careful treatment in the literature. Empirical results are given for fixed sample size, relative width, and absolute width procedures which can be used for constructing confidence intervals for measures of performance in the terminating case. GRA

N79-10794# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.
NEAR OPTIMAL FEEDBACK STABILIZATION OF A CLASS OF NONLINEAR SINGULARLY PERTURBED SYSTEMS
Joe H. Chow and Petar V. Kokotovic Oct. 1977 34 p refs
(Contract DAAB07-72-C-0259; Grant AF-AFOSR-2570-73)
(AD-A056536; R-795; UILU-eng-77-2242) Avail: NTIS HC A03/MF A01 CSCL 09/3

A new series expansion method is developed for a class of nonlinear singularly perturbed optimal regulator problems. The resulting feedback control is near-optimal and can stabilize essentially nonlinear systems when linearized models provide no stability information. The stability domain is shown to include large initial conditions of the fast variables. The control law is implemented in two-time scales, with the feedback from the fast state variables depending on slow state variables as parameters. The coefficients of the formal expansions of the optimal value function are obtained from equations involving only the slow variables. Author (GRA)

N79-10795# Illinois Univ. at Urbana-Champaign, Urbana. Decision and Control Lab.
THE TIME-OPTIMAL CONTROL OF SINGULARLY PERTURBED SYSTEMS Ph.D. Thesis
Shabon Harold Javid Oct. 1977 114 p refs
(Contract DAAB07-72-C-0259; Grant AF-AFOSR-2570-73)
(AD-A056841; DC-5) Avail: NTIS HC A06/MF A01

Control problems for singularly perturbed systems with unconstrained control have been given considerable attention and major results have been obtained. For these problems the concept of time scale decomposition has been developed providing a separation of slow and fast dynamics and a reduction in problem order. Author (GRA)

N79-10796# National Technical Information Service, Springfield, Va.
PATTERN RECOGNITION AND IMAGE PROCESSING, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1975 - Jul. 1977
David W. Grooms Aug. 1978 153 p
(NTIS/PS-78/0845/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The bibliography cites research reports on pattern recognition and image processing. Research on processing color pictures, image enhancement and restoration, feature extraction, edge detection, and scene analysis are included. This updated bibliography contains 294 abstracts, none of which are new entries to the previous edition. GRA

N79-10797# National Technical Information Service, Springfield, Va.
PATTERN RECOGNITION AND IMAGE PROCESSING, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Aug. 1977 - Jul. 1978
George W. Reimherr Aug. 1978 301 p Supersedes NTIS/PS-77/0686; NTIS/PS-76/0609; NTIS/PS-75/514; NTIS/PS-74/084
(NTIS/PS-78/0846/2; NTIS/PS-77/0686; NTIS/PS-76/0609; NTIS/PS-75/514; NTIS/PS-74/084) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The bibliography cites research reports on pattern recognition and image processing. Research on processing color pictures, image enhancement and restoration, feature extraction, edge detection, and scene analysis are included. Optical character recognition is excluded. This updated bibliography contains 146 abstracts, all of which are new entries to the previous edition. GRA

N79-10798# National Technical Information Service, Springfield, Va.
MACHINE AUTOMATION AND NUMERICAL CONTROL, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1974 - Jun. 1977
Guy E. Habercom, Jr. Aug. 1978 261 p
(NTIS/PS-78/0752/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Automation of machines and machine tools and numerical control methods are investigated in the cited reports. Manufacturing techniques, production control, and process control methods are reviewed. This updated bibliography contains 254 abstracts, none of which is new to the previous edition. GRA

N79-10799# National Technical Information Service, Springfield, Va.
MACHINE AUTOMATION AND NUMERICAL CONTROL, VOLUME 4. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1977 - Jun. 1978
Guy E. Habercom, Jr. Aug. 1978 101 p Supersedes NTIS/PS-77/0652; NTIS/PS-76/0541; NTIS/PS-75/482
(NTIS/PS-78/0753/0; NTIS/PS-77/0652; NTIS/PS-76/0541; NTIS/PS-75/482) Avail: NTIS HC $28.00/MF $28.00 CSCL 13H

Manufacturing techniques, process control, and production control are subjects covered in this bibliography which cites reports on the automation of machines and machine tools and methods for their numerical control. Of the 95 abstracts presented, 88 are new entries to the previous edition. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N79-10800 California Inst. of Tech., Pasadena.
THE SOLUTIONS OF A NONLINEAR DIFFERENCE EQUATION FOUND IN NUMERICAL ANALYSIS Ph.D. Thesis
Bruce Donald Westermo 1978 117 p
Avail: Univ. Microfilms Order No. 7815983

The solutions of a nonlinear difference equation resulting from the trapezoidal quadrature approximation of a piecewise

linear differential equation are examined. A phase plane mapping technique is used to find the periodic and unbounded solutions of the difference equation and to determine the stability of these solutions. The maximum rate of Hamiltonian increase of the unbounded solutions is calculated from the mapping transformations. It is shown that the stability of a solution can only be guaranteed for discrete ranges of the time step with fixed initial conditions. The solutions of the non-autonomous difference equations for a sinusoidal forcing term and the damped difference equations are also examined. Dissert. Abstr.

N79-10801 Carnegie-Mellon Univ., Pittsburgh, Pa.
FILTER MONADS AND COMPACT SPACE OBJECTS IN ELEMENTARY TOPOI Ph.D. Thesis
Harry Joseph Porta 1978 194 p
Avail: Univ. Microfilms Order No. 7815187

The relationship of the category of algebras is examined for the ultrafilter monad on an elementary topos E and a more topologically defined category of compact Hausdorff space objects in E. Several monads analogous to filter monads on the category of sets are constructed using the internal logical operations on power set objects. For each filter monad, a category of compact Hausdorff space objects is defined in terms of filter convergence. Each compact Hausdorff space has a corresponding filter monad algebra structure on its underlying object, and the correspondence is functorial, perserving underlying morphisms. The most interesting result in the other direction is that for each topos in a large class of topoi, and a certain filter monad, each free filter algebra comes from a compact Hausdorff space.
Dissert. Abstr.

N79-10802 California Inst. of Tech., Pasadena.
BOUNDARY VALUE PROBLEMS OVER SEMI-INFINITE INTERVALS Ph.D. Thesis
Marianela LentiniGil 1978 129 p
Avail: Univ. Microfilms Order No. 7816953

A theory of existence and uniqueness of bounded solutions of linear and nonlinear boundary value problems over a semiinfinite interval is developed. A numerical method for solving such problems is proposed. The method uses only finite intervals and convergence is proven as the length of the interval goes to infinity. This work is extended to problems over $0 < \text{or} = t <$ infinity with a regular singular point at $t = 0$. The techniques developed are applied to solve three problems. Dissert. Abstr.

N79-10803 California Inst. of Tech., Pasadena.
NONLINEAR OSCILLATIONS IN DISCRETE AND CONTINUOUS SYSTEMS Ph.D. Thesis
John Charles Neu 1978 102 p
Avail: Univ. Microfilms Order No. 7816955

A perturbation method for resonantly coupled nonlinear oscillators is decribed. Equations with simple structure that describe the long time evolution of the motion are derived by successive near-identity transformations of the original equations. Using this method, resonance in conservative, nonconservative, and time dependent problems is investigated. The coupling of nonlinear chemical oscillators is studied. The propagation of chemical waves of an oscillating reaction in a diffusive medium, the interaction between a pair of coupled chemical oscillators, and large systems of coupled chemical oscillators are analyzed.
Dissert. Abstr.

N79-10804 Rice Univ., Houston, Tex.
ON THE METHOD OF CONJUGATE GRADIENTS FOR FUNCTION MINIMIZATION Ph.D. Thesis
Jorge Moncada Nocedal 1978 79 p
Avail: Univ. Microfilms Order No. 7814787

Two families of algorithms that combine conjugate gradient steps and quasi-Newton updates are studied. The first consists in interleaving the two iterations, the second is a conjugate gradient method with respect to a metric that is constructed by quasi-Newton corrections. It is shown that the two families can be implemented so as to have quadratic termination and that for sufficiently accurate line searches they are N-step quadratically convergent. Conjugate gradient algorithms that do not require line searches are analyzed. Some results concerning their use on combined methods are given. Several particular algorithms are tested through a set of numerical examples. Dissert. Abstr.

N79-10805 Pennsylvania State Univ., University Park.
QUADRATIC FORM SCHEMES Ph.D. Thesis
Joseph Lewis Yucas 1978 89 p
Avail: Univ. Microfilms Order No. 7818801

A theory is constructed to resemble the classical theory of quadratic forms over an arbitrary field as much as possible, but one which is also general enough to include the theory of quadratic forms over a semilocal ring in which 2 is a unit and whose residue class fields contain more than 3 elements. This construction is done without any use of a field or ring structure. Groups of exponent 2 are used only. Such topics as quadratic and semiquadratic form schemes, Hasse principles, classification, Witt rings and signatures are studied. Dissert. Abstr.

N79-10806 Montana Univ., Flathead Lake.
EXISTENCE AND MULTIPLICITY OF CONTINUA FOR NONLINEAR OPERATOR EQUATIONS Ph.D. Thesis
Katherine Ann Yerion 1978 133 p
Avail: Univ. Microfilms Order No. 7819155

The deficiences which currently exist in the theory are: (1) the lack of unifying principles between sublinear and superlinear equations, between homogeneous and nonhomogeneous equations, and between single-parametered and multiparametered equations; (2) the lack of sufficient conditions for bifurcation to occur at every eigenvalue of the linearized operator where the nonlinear operator is superlinear or sublinear of any degree; and (3) the lack of existence and multiplicity results for solutions of nonhomogeneous equations. In this paper these deficiencies are remedied by obtaining symmetry principles between superlinear and sublinear equations; by obtaining sufficient conditions for bifurcation to occur at every eigenvalue of finite multiplicity of the linearized operator. Dissert. Abstr.

N79-10807 South Florida Univ., St. Petersburg.
CONTRIBUTIONS TO THE OSCILLATION THEORY OF MATRIX AND SCALAR DIFFERENTIAL EQUATIONS Ph.D. Thesis
Terry James Walters 1978 52 p
Avail: Univ. Microfilms Order No. 7819000

The oscillation of second order matrix differential equations of the form $(Q(t)Y) + P(t)Y = 0$ is discussed. The matrix equation is associated with the scalar equation in oscillation. The vector equation is examined. Results for the scalar equation employ a transformation involving the solutions to the equations.
Dissert. Abstr.

N79-10808 Denver Univ., Colo.
AN ANALYSIS OF THE APERTURE LIMITED FOURIER INVERSION OF CHARACTERISTIC FUNCTIONS Ph.D. Thesis
Judith Anne Armstrong 1978 43 p
Avail: Univ. Microfilms Order No. 7818645

An integral representation of the problem is examined by the method of multidimensional stationary phase. This is an asymptotic technique which can be applied since the problem involves only high frequency, large k, information. The method determines which points of the domain of integration are critical, and to what order in k they may be expected to contribute to an asymptotic expansion of the integral. It predicts that contributions from certain other critical points might actually interfere with the first order contribution, the one which produces the peak on the boundary of the scatter. The very careful analysis done allows the conclusion that there is no interference due to a depressed amplitude at those points. Numerical tests were done which substantiate the analytical results. Dissert. Abstr.

N79-10809*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXTENSION OF A-STABILITY TO ALTERNATING DIRECTION IMPLICIT METHODS
R. F. Warming and Richard M. Beam Oct. 1978 50 p refs (NASA-TM-78537; A-7614) Avail: NTIS HC A03/MF A01 CSCL 12A

An alternating direction implicit (ADI) scheme was constructed by the method of approximate factorization. An A-stable linear multistep method (LMM) was used to integrate a model two-dimensional hyperbolic-parabolic partial differential equation. Sufficient conditions for the A-stability of the LMM were

determined by applying the theory of positive real functions to reduce the stability analysis of the partial differential equations to a simple algebraic test. A linear test equation for partial differential equations is defined and then used to analyze the stability of approximate factorization schemes. An ADI method for the three-dimensional heat equation is also presented. S.B.S.

N79-10810*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DESIGN OF TRANSONIC AIRFOIL SECTIONS USING A SIMILARITY THEORY

David Nixon Oct. 1978 21 p refs

(NASA-TM-78521; A-7597) Avail: NTIS HC A02/MF A01 CSCL 12A

A study of the available methods for transonic airfoil and wing design indicates that the most powerful technique is the numerical optimization procedure. However, the computer time for this method is relatively large because of the amount of computation required in the searches during optimization. The optimization method requires that base and calibration solutions be computed to determine a minimum drag direction. The design space is then computationally searched in this direction; it is these searches that dominate the computation time. A recent similarity theory allows certain transonic flows to be calculated rapidly from the base and calibration solutions. In this paper the application of the similarity theory to design problems is examined with the object of at least partially eliminating the costly searches of the design optimization method. An example of an airfoil design is presented. Author

N79-10811*# National Aeronautics and Space Administration, Washington, D. C.

NONPARAMETRIC ALGORITHMS FOR THE SEARCH OF SIGNALS

T. S. Myshenkova Oct. 1978 18 p refs Transl. into ENGLISH of "Neparametricheskiye Algoritmy Poiska Signalov", Rept. PR-277 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1976 p 1-18 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-75565; PR-277) Avail: NTIS HC A02/MF A01 CSCL 12A

Two algorithms for the search of signals in noise are constructed. Two independent measurable properties of a discreet time-dependent stochastic process F are described. The functions A sub K and B sub K fully satisfy conditions for the application of a test based on Spearman's rank correlation coefficient. A statistic to which the one-sided signal test can be applied is constructed under sufficiently natural assumptions about the noise process. The constructed statistics are simplified. Processing results from calculations of statistics constructed for concrete processes are presented. J.M.S.

N79-10812# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

FEATURE SELECTION AND SAMPLE CLASSIFICATION ALGORITHMS OF INPE

R. Kumar Sep. 1977 13 p refs

(INPE-1120-PE/088) Avail: NTIS HC A02/MF A01

In the remote sensing of earth resources, the problem of feature selection is discussed. An algorithm for feature selection based on B-distance was developed. The algorithm is used for LANDSAT data, aircraft multispectral scanner (MSS) data, and SKYLAB MSS data. A branch and bound algorithm to select the best subset of n features from a set of N features without exhaustive search is developed. A sample classifier based on B-distance was developed. B-distance is computed between a test field and each of the training classes and classified into the class for which the B-distance is minimum. S.E.S.

N79-10813# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

NOTES ON THE DISPERSION OF REAL VECTOR ENSEMBLES AND APPLICATIONS

Aydano Barreto Carleial Sep. 1978 25 p refs

(INPE-1356-NTE/133) Avail: NTIS HC A02/MF A01

The mutual information between two signals defined on continuous alphabets can be calculated through the dispersion (differential entropy) of the signals. This report contains a tutorial exposition of the definition and some basic properties of the dispersion of vector signals, the interest of which resides in the calculation of mutual informations that often occur in communication network problems. The evaluation of the capacity of a channel with parallel links and the computation of a bound on the capacity of the Gaussian interference channel are presented as examples of application. Author

N79-10814# Naval Surface Weapons Center, Dahlgren, Va.

NSWC/DL LIBRARY OF MATHEMATICS SUBROUTINES

Alfred H. Morris, Jr. Jun. 1978 116 p

(AD-A056928; NSWC/DL-TR-3843) Avail: NTIS HC A06/MF A01 CSCL 12/1

This report describes a high quality collection of general-purpose mathematics subroutines for the CDC 6700 computer. Nearly all the routines are written in FORTRAN. Included are routines for computing Bessel functions, evaluating the complete and incomplete elliptic integrals of the first, second, and third kinds, finding least squares solutions for systems of linear equations, computing eigenvalues and eigenvectors of matrices, solving linear programming problems, computing definite integrals, and solving systems of ordinary differential equations. The routines have been selected from a variety of sources. Author (GRA)

N79-10815*# Cambridge Hydrodynamics, Inc., Mass.

NUMERICAL ANALYSIS OF SPECTRAL METHODS

David Gottlieb and Steven A. Orszag Jun. 1977 275 p refs

(Contracts NAS1-14101; N00014-77-C-0138)

(NASA-CR-157778; AD-A056922; CHI-5) Avail: NTIS HC A12/MF A01 CSCL 12/1

This monograph gives a mathematical analysis of spectral methods for mixed initial-boundary value problems. Spectral methods have become increasingly popular in recent years, especially since the development of fast transform methods, with applications in numerical weather prediction, numerical simulations of turbulent flows, and other problems where high accuracy is desired for complicated solutions. The development of a mathematical theory is given that explains why spectral methods work and how well they work. GRA

N79-10816# Wisconsin Univ. - Madison. Mathematics Research Center.

A VARIATION METHOD FOR FINDING PERIODIC SOLUTIONS OF DIFFERENTIAL EQUATIONS

Paul H. Rabinowitz May 1978 31 p refs

(Contracts DAAG29-75-C-0024)

(AD-A056718; MRC-TSR-1854; N00014-76-C-0300) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper concerns the use of minimax and approximation techniques from the calculus of variations to prove the existence of periodic solutions of Hamiltonian systems of ordinary differential equations. Most of the results are for equations where the period is prescribed and assumptions are made about the growth of the Hamiltonian near infinity. However it is also shown how such results can give information about solutions having prescribed energy. Author (GRA)

N79-10817# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.

AN OPTIMAL ALGORITHM FOR FINDING THE KERNEL OF A POLYGON

D. T. Lee and F. P. Preparata Jul. 1977 12 p refs

(Contract DAAB07-72-C-0259; Grant NSF MCS-76-17321)

(AD-A056887; R-783; UILU-ENG-77-2230) Avail: NTIS HC A02/MF A01 CSCL 12/1

The kernel K(P) of a simple polygon P with n vertices is the locus of the points internal to P from which all vertices of P are visible. Equivalently, K(P) is the intersection of appropriate half-planes determined by the polygon's edges. Although the intersection of n generic half-planes is known to require time O(n log n), we show that one can exploit the ordering of the half-planes corresponding to the sequence of the polygon's edges to obtain a kernel finding algorithm which runs in time O(n) and is therefore optimal. Author (GRA)

N79-10818# Brown Univ., Providence, R. I. Center for Dynamical Systems.

NONLINEAR OSCILLATIONS IN EQUATIONS WITH DELAYS Interim Report
Jack K. Hale May 1978 67 p refs
(Grant AF-AFOSR-3092-76; DA-ARO-31-124-73-G130; NSF MCS-76-07247)
(AD-A056745; AFOSR-78-1178TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

These lectures are concerned only with some aspects of bifurcation theory in the local theory of nonlinear oscillations in equations with delays; that is, behavior of solutions near an equilibrium. In particular, how the qualitative behavior of solutions change is shown as parameters vary. A detailed study of the local theory is important in order to know the types of solutions to expect in a global problem. Of course, there is no reason to only study local theory near an equilibrium. One should study how the qualitative behavior changes near any invariant set, for example, behavior near a periodic orbit, behavior near an orbit which connects a saddle point to itself, etc. More complicated behavior is expected near these large invariant sets. One can obtain invariant torii, homoclines points which exhibit a chaotic behavior, etc. GRA

N79-10819# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON SUBJECT SELECTION PROCEDURES FOR POISSON POPULATIONS
Shanti S. Gupta, Yoon-Kwai Leong, and Wing-Yue Wong May 1978 35 p refs
(Contract N00014-75-C-0455)
(AD-A056577; MIMEO-Ser-78-3) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper deals with the problem of selecting a subset containing the smallest parameter of k(= or − 2) Poisson populations. The population parameters lambda sub i, i−1.2,...,k are assumed unknown and there is no a priori information about the correct pairing of the ordered and unordered lambda sub i's. Both unconditional and conditional selection rules are investigated. Tables are provided for approximate values of the constants necessary to carry out the procedures. Some other numerical computations have also been provided which shed light on the performance of the selection rule in terms of the probability of selecting a non-best population, the probability of a correct selection and the expected proportion in the selected subset. GRA

N79-10820# National Range Operations Directorate, White Sands Missile Range, N. Mex. Analysis and Computation Div.
ROBUST REGRESSION: COMPUTATIONAL METHODS FOR M-ESTIMATES
William S. Agee and Robert H. Turner Jun. 1978 54 p refs
(AD-A056792; ACD-TR-66) Avail: NTIS HC A04/MF A01 CSCL 12/1

The computation of robust M-estimates of regression is considered in detail using the Psi functions of Huber, Andrews, and Hampel. The computation of M-estimates of regression is considered for linear models, linear models with vector observations, and nonlinear models. Examples are given using actual data for each of these different classes of models. Careful attention is given to the important problem of convergence of M-estimates with redescending Psi functions. A lengthy treatment of this problem is given for the Daniel and Wood data by considering several starting methods for the iterative solution and different breakpoints for the Psi functions. Author (GRA)

N79-10821# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.
FINDING THE INTERSECTION OF TWO CONVEX POLYHEDRA
D. E. Muller and F. P. Preparata Oct. 1977 38 p refs
(Contract DAAB07-72-C-0259; Grant NSF MCS-76-17321)
(AD-A056889; R-793; UILU-ENG-77-2240) Avail: NTIS HC A03/MF A01 CSCL 12/1

Given two convex polyhedra in three-dimensional space, an algorithm is developed to (1) test whether their intersection is empty, and (2) if so to find a separating plane, while (3) if not to find a point in the intersection and explicitly construct their intersection polyhedron. The algorithm runs in time O(nlogn), where n is the sum of the numbers of vertices of the two polyhedra. The part of the algorithm concerned with (3) (constructing the intersection) is based upon the fact that if a point in the intersection is known, then the entire intersection is obtained from the convex hull of suitable geometric duals of the two polyhedra taken with respect to this point. Author (GRA)

N79-10822# Illinois Univ., Urbana. Dept. of Computer Science.
NUMERICAL INTEGRATORS FOR STIFF AND HIGHLY OSCILLATORY DIFFERENTIAL EQUATIONS
Simeon Ola Fatunla Oct. 1977 33 p refs
(Contract EY-76-S-02-2383)
(COO-2383-0044; UIUCDCS-R-77-894; UILU-ENG-77-1751)
Avail: NTIS HC A03/MF A01

Some L-stable, fourth-order, explicit, and one-step numerical integration formulas which require no matrix inversion are proposed to cope effectively with systems of ordinary differential equations with large Lipschitz constants (including those having highly oscillatory solution). An implicit integration procedure is developed to handle a class of stiff systems as well as those with highly oscillatory solutions. The same pair of nonlinear equations is solved for the stiffness/oscillatory parameters, however, the nonlinear systems are transformed into linear forms and an efficient computational procedure is developed to obtain these parameters. The new schemes compare favorably with the backward differentiation formula (DIFSUB) of Gear, the blended linear multistep methods of Skeel and Kong, and the symmetric multistep methods of Lambert and Watson. DOE

N79-10823# National Technical Information Service, Springfield, Va.
THE USE OF COMPUTERS IN SOLVING MATHEMATICAL PROBLEMS. VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1971-1975
George W. Reimherr Aug. 1978 263 p
(NTIS/PS-78/0781/1) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The computer solution of algebraic and differential equations is reported. The necessary software and hardware for implementation, as well as solutions to large sparse matrices, stiff differential equations, and statistical problems, are included. Some of the research is directly applicable to various physical sciences. This updated bibliography contains 256 abstracts, none of which are new entries to the previous edition. GRA

N79-10824# National Technical Information Service, Springfield, Va.
THE USE OF COMPUTERS IN SOLVING MATHEMATICAL PROBLEMS. VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Jul. 1978
George W. Reimherr Aug. 1978 101 p Supersedes NTIS/PS-77/0780; NTIS/PS-76/0667; NTIS/PS-75/485; COM-74-11454
(NTIS/PS-78/0782/9; NTIS/PS-77/0780; NTIS/PS-76/0667; NTIS/PS-75/485; COM-74-11454) Avail: NTIS HC $28.00/MF $28.00 CSCL 09B

The computer solution of algebraic and differential equations is reported. The necessary software and hardware for implementation, as well as solutions to large sparse matrices, stiff differential equations, and statistical problems, are included. Some of the research is directly applicable to various physical sciences. This updated bibliography contains 94 abstracts, 24 of which are new entries to the previous edition. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N79-10825 Rochester Univ., N. Y.
SOME ESTIMATION PROBLEMS IN DISCRIMINANT ANALYSIS Ph.D. Thesis
Atsu Shelter Dorvlo 1977 210 p
Avail: Univ. Microfilms Order No. 7815271

The Jack-Knife method is applied in three different ways to the linear discriminant function and the efficiency of the resulting

procedures is evaluated. Fisher's linear discriminant function and an unbiased estimate of it are also considered. Effects of sample size, number of variables and unequal covariance matrices are examined. In order to evaluate the effect of non-normality, the investigation is conducted with the Lognormal and Logit distributions. The optimum linear and quadratic discriminant functions are compared when the covariance matrices are unequal and known and the means are estimated. Jack-knife type estimators for the probability of misclassification and the probability of correct classification are suggested for the two and three population cases. Dissert. Abstr.

N79-10826 Temple Univ., Philadelphia, Pa.
A P.D.F.-ORIENTED APPROACH TO STOCHASTIC DEPENDENCE WITH FIXED MARGINALS Ph.D. Thesis
Joshua Paul Seeger 1978 145 p
Avail: Univ. Microfilms Order No. 7817343

Elements of the Frechet class are studied from the viewpoint of their densities. Various extensions are made of the Frechet bounds. They are generalized to n-dimensions as singular distributions satisfying various properties of extreme dependence. The moment of inertia of a distribution about a line or a curve is defined and proposed as a multivariate measure of dependence. The feasibility of classifying, measuring, and constructing dependent distributions according to their multivariate p.d.f.'s is examined. Dissert. Abstr.

N79-10827# State Univ. of New York at Buffalo, Amherst. Statistical Science Div.
MAXIMUM ROBUST LIKELIHOOD ESTIMATION Final Report, 5 Jun. 1976 - 31 Jul. 1978
Emanuel Parzen Jul. 1978 11 p
(Grant DAAG29-76-G-0239)
(AD-A056725; ARO-13845.2-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

After a statement describing the over-all goals and personnel of this research project, this final report contains: a list of technical reports on research supported by this project, and a description of research accomplishments as given in the abstracts or introductions of the technical reports which have been issued. Author (GRA)

N79-10828# Rockwell International Corp., Tulsa, Okla.
LIFE-TEST SAMPLING PLANS FOR TWO-PARAMETER WEIBULL POPULATIONS
K. W. Fertig and Nancy R. Mann May 1978 28 p refs
(Contract N00014-73-C-0474; N00014-76-C-0723)
(AD-A056846) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper gives variables sampling plans for data that are distributed as either extreme-value variates or Weibull variates (the logarithms of which are from an extreme-value distribution). Tables applying to acceptance regions and operating characteristics for sample size, n, ranging from 3 to 18 are given. The tables allow for Type-II censoring, with censoring number, r, ranging from 3 to n. Acceptance/rejection is based upon a statistic incorporating best linear invariant estimates or, alternatively, maximum-likelihood estimates of the location and scale parameters of the underlying extreme-value distribution. GRA

N79-10829# State Univ. of New York at Buffalo, Amherst. Statistical Science Div.
NONPARAMETRIC STATISTICAL DATA MODELING
Emanuel Parzen Jan. 1978 70 p refs
(Grant DAAG29-76-G-0239)
(AD-A056827; ARO-13845.6-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

It is the aim of this paper to introduce new types of keys for exploratory data analysis (of continuous data) based on estimating the quantile function and density quantile function. The distinction between exploratory and confirmatory data analysis can be regarded as a distinction between confirmatory nonparametric statistical data analysis or modeling, and confirmatory parametric statistical data analysis. Quantile, quantile-density, density-quantile, and score functions are defined in Section 2, and their fundamental inter-relations are discussed. Transformations to observed data which have specified distributions are studied in Section 3, and formulas are given for their derivatives. Auto-regressive representations of density-quantile functions are introduced in Section 4. Sample quantile functions and their linear functionals are defined in Section 5. Goodness of Fit Tests for location and scale parameter models are introduced in Section 6. Estimators of density-quantile functions are discussed in Section 7. Section 8 considers two examples -- Rayleigh data and Buffalo snowfall. Section 9 discusses theoretical examples of density-quantile functions, and their classification according to tail behavior. Location and scale parameter estimation is discussed in Section 10. Section 11 lists some open research problems for extensions. GRA

N79-10830# Oklahoma State Univ., Stillwater. College of Business Administration.
MONTE CARLO BAYESIAN SYSTEM RELIABILITY, AND MTBF-COINCIDENCE ASSESSMENT, 2. VOLUME 1: THEORY Final Report, Mar. 1976 - Dec. 1977
Mitchell O. Locks and Keun K. Lee Mar. 1978 65 p refs
(Contract F33615-76-C-3094; AF Proj. 2304)
(AD-A057068; AFFDL-TR-78-18-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 14/1

SPARCS-2 (Simulation Program for Assessing the Reliabilities of Complex Systems, Version 2) is a PL/1 computer program for assessing (establishing interval estimates for) the reliability and the MTBF of a large and complex system of any modular configuration. The system can consist of a complex logical assembly of independently failing attribute (binomial-Bernoulli) and time-to-failure (Poisson-exponential) components, without any regard to their placement. Alternatively, it can be a configuration of independently failing modules, where each module has either or both attribute and time-to-failure components. The raw data for assessments are the component failure history data and the system configuration. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

No abstracts in this category.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N79-10831 Carnegie-Mellon Univ., Pittsburgh, Pa.
FUNCTION SPACES IN THE CATEGORY OF UNIFORM CONVERGENCE SPACES Ph.D. Thesis
Rosalyn Hsiaomei Shen Lee 1978 55 p
Avail: Univ. Microfilms Order No. 7815184

The adjoint functorial relations among the categories of topological, pseudotopological uniform, convergence, pseudouniform convergence and uniform convergence spaces are obtained, after a general discussion of categorical theory and basic properties of uniform convergence spaces which are used in the thesis. The category of uniform convergence spaces is proved to be Cartesian closed, with function spaces provided with the structure of uniform continuous convergence. Different convergence structures of function spaces are compared and the completeness property examined. Dissert. Abstr.

N79-10832 Wayne State Univ., Detroit, Mich.
PROPERTIES OF CONTRACTIBLE FANS Ph.D. Thesis
Lex Gerard Oversteegen 1978 82 p
Avail: Univ. Microfilms Order No. 7816066

A new motion that guarantees non-contractibility for metric spaces and is especially useful in the class of dendroids is introduced. A class of dendroids, namely that of the so called fans, is investigated. A combinatorial argument was used to prove that every contractible fan is locally connected at the vertex. This theorem is used to give an internal characterization of contractibility for fans and to show that a fan is contractible if and only if is is monotone contractible. A particular embedding

in the plane was provided under some additional conditions. Results indicate that every contractible fan is embeddable in the plane. Dissert. Abstr.

N79-10833 Lehigh Univ., Bethlehem, Pa.
INVARIANCE THEORY IN CONTINUUM MECHANICS Ph.D. Thesis
Edward Joseph Fahy 1978 148 p
Avail: Univ. Microfilms Order No. 7815808

The first part of this dissertation is concerned with the determination of the general form of the constitutive relation which yields the stress at the particle in a simple fluid given the history of the motion of the particles in the immediate vicinity of the particle considered. Part two is concerned with constitutive equations of thermoviscous simple fluids. The general scalar, vector and symmetric second-order tensor valued functions of two symmetric second-order tensors and one vector are given. In part three a simple classification is performed using group integration for invariants multilinear in second-order symmetric tensors and of degree zero or one in a covariant vector u. In part four the general expression for a three-dimensional third-order tensor valued polynomial function multilinear in an arbitrary number of three dimensional symmetric second-order tensors whose form remains invariant under the proper orthogonal group is derived. Dissert. Abstr.

N79-10834 South Carolina Univ., Columbia.
LAWS OF LARGE NUMBERS FOR D[0,1] AND RELATED TOPICS Ph.D. Thesis
Peter Zito Daffer 1978 73 p
Avail: Univ. Microfilms Order No. 7816500

Laws of large numbers are proved for random elements taking values in D [0,1] or in a topological vector space. The structure of D [0,1], when given the Skorokhod topology, presented the task of obtaining laws of large numbers with formidable difficulties. For this reason, the geometry of D [0,1] is investigated in detail and a characterization of the convex compact sets in D [0,1] is given. Counterexamples are given for properties one might hope for, and lemmas on properties of the Skorokhod metric are proved. Some laws of large numbers for weakly uncorrelated random elements in a Banach space are proved. The results are generalized to random elements taking values in a locally convex topological vector space. Hypotheses of completeness and reflexivity are used where needed.
Dissert. Abstr.

N79-10835 Texas A&M Univ., College Station.
DIGRAPHS, AUTOMATA AND SANDWICH SEMIGROUPS OF BINARY RELATIONS Ph.D. Thesis
Karen Hafen Chase 1978 81 p
Avail: Univ. Microfilms Order No. 7817170

An outgrowth of recent work done investigating the transfer of information between automata and various semigroups associated with automata is presented. The concept of S-semigroups is examined and new semigroups in terms of pathwise isomorphism is generalized. The semigroups are shown to be isomorphic in a certain sense if and only if their respective machines are pathwise isomorphic. Digraphs associated with automata are investigated. New semigroups are associated with automata which lead naturally to new semigroups of binary relations. A new multiplication on binary relations by means of an arbitrary but fixed sandwich relation is introduced. Algorithms for constructing idempotents and regular elements in these new semigroups are given. There are classes of sandwich relations for which some but not all groups appear as maximal groups and classes in which the only maximal groups are trivial.
Dissert. Abstr.

N79-10836 Carnegie-Mellon Univ., Pittsburgh, Pa.
EXTENSIONS OF FOURIER'S TREATMENT OF LINEAR INEQUALITY SYSTEMS Ph.D. Thesis
Jeff Tracy Buckwalter 1978 143 p
Avail: Univ. Microfilms Order No. 7815196

Fourier treated linear inequality systems by a method of eliminating variables one by one. An extension of this method which eliminates variables in blocks is discussed. The extended method, which uses determinants to generalize the single variable elimination method of Fourier, is called block Fourier elimination. The block Fourier algorithm using the dual system, which is a system of linear equations having positive variables is presented. An analysis of the underlying geometry of the block Fourier algorithm yielding a classification theorem for the intersection of certain types of halfspaces is reported. A formula for the area of the intersection of certain halfplanes is described. Applications of the method are presented, particularly in the area of linear programming. A summary of computer experience with the algorithm is reported. A brief users' manual and documentation for the computer code is included as an appendix. Dissert. Abstr.

N79-10837 Carnegie-Mellon Univ., Pittsburgh, Pa.
AN AXIOMATIC FOUNDATION FOR FINITE-DIMENSIONAL QUANTUM THEORY Ph.D. Thesis
Ray Edison Artz, Jr. 1978 177 p
Avail: Univ. Microfilms Order No. 7815914

A sliced cone is a convex linear cone equipped with a prescribed strictly positive linear functional. In quantum theory members of the cone and the prescribed functional can be interpreted, respectively, as beams of particles and as a device which counts the numbers of particles per unit time carried by those beams. Complex Hilbert spaces play their role in quantum mechanics only through the intrinsic geometry of their sliced cones of trace-class positive Hermitian operators (equipped with the trace functionals). An intrinsic characterization of those sliced cones which are applicable (that is, which are isomorphic to sliced cones of trace-class positive Hermitian operators on complex Hilbert spaces) is presented for the case where the cones are finite-dimensional. Dissert. Abstr.

N79-10838# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
A NOTE ON OPTIMAL SUBSET SELECTION PROCEDURES
Shanti S. Gupta and Huang Deng-Yuan Jun. 1978 10 p refs
(Contract N00014-75-C-0455)
(AD-A056734; MMS-470-Rev) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper concerns the construction of optimal subset selection procedures. Some classical selection procedures are considered as special cases. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N79-10839 Wayne State Univ., Detroit, Mich.
COMPUTATION OF RIGID BODY ROTATION IN THREE-DIMENSIONAL SPACE FROM BODY-FIXED ACCELERATION MEASUREMENTS Ph.D. Thesis
Naveen Kumar Mital 1978 456 p
Avail: Univ. Microfilms Order No. 7818593

A versatile analog-to-digital conversion program in PAL-8 assembly language was developed and implemented on a PDP-8/E computer, to digitize the experimentally acquired data at a rate which was at least twice that of the highest frequency present in the data. Extensive computer programs (in FORTRAN code) were developed to analyze the data on an IBM 360/67 and AMDAHL 470/V6 computer. It included frequency analysis by fast Fourier transform and simulation of a variety of digital filters. Mathematical programs were developed to compute body-fixed angular acceleration, angular velocity and rigid body rotation in three-dimensional space. Dissert. Abstr.

N79-10840# Argonne National Lab., Ill.
REPORT OF THE ANL TECHNICAL ADVISORY PANEL ON PHYSICS WITH POLARIZED BEAMS AND TARGETS
A. W. Hendry, R. A. Arndt, and D. G. Crabb Feb. 1978 38 p refs
(Contract W-31-109-eng-38)
(ANL-HEP-TR-78-19) Avail: NTIS HC A03/MF A01

Recent experimental measurements made at the ZGS are cited. Their implications and recommendations for further experiments are discussed. Areas covered are elastic proton-proton

scattering, neutron-proton scattering, low energy nucleon-nucleon scattering, and experiments at large t. An overall summary showing the various parts of the nucleon-nucleon picture is included along with related information frequently used by researchers in this area. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N79-10841 Catholic Univ. of America, Washington, D. C.
EVALUATION OF THE RELATIVE IMPORTANCE OF CIRCUMFERENTIAL OR CREEPING WAVES IN THE ACOUSTIC SCATTERING FROM RIGID AND ELASTIC SOLID CYLINDERS AND FROM CYLINDRICAL SHELLS Ph.D. Thesis
Louis Raymond Dragonette 1978 99 p
Avail: Univ. Microfilms Order No. 7816865

The scattering by a sound aluminum cylinder in water is described in terms of a rigid body background on which a resonance behavior is superimposed. This observation is formalized by a mathematical separation of the normal model scattering solution into rigid body and resonance terms. An explicit expression is obtained for the resonance widths. Fast Fourier transform techniques are used to compute the echoes which result when thin cylindrical shells scatter short incident acoustic pulses. The number of circumferential waves, their velocity, and their relative significance are obtained directly from the normalized backscattered pressure amplitude. The frequency range of excitation of specific circumferential waves on cylindrical shells is predicted by analysis of Lamb dispersion curves for flat plates.

Dissert. Abstr.

N79-10842*# Lockheed-Georgia Co., Marietta.
DUCT WALL IMPEDANCE CONTROL AS AN ADVANCED CONCEPT FOR ACOUSTIC SUPPRESSION ENHANCEMENT Final Report
Peter D. Dean Oct. 1978 115 p refs
(Contract NAS3-20071)
(NASA-CR-159425; LG78ER0243) Avail: NTIS HC A06/MF A01 CSCL 20A

A systems concept procedure is described for the optimization of acoustic duct liner design for both uniform and multisegment types. The concept was implemented by the use of a double reverberant chamber flow duct facility coupled with sophisticated computer control and acoustic analysis systems. The optimization procedure for liner insertion loss was based on the concept of variable liner impedance produced by bias air flow through a multilayer, resonant cavity liner. A multiple microphone technique for in situ wall impedance measurements was used and successfully adapted to produce automated measurements for all liner configurations tested. The complete validation of the systems concept was prevented by the inability to optimize the insertion loss using bias flow induced wall impedance changes. This inability appeared to be a direct function of the presence of a higher order energy carrying modes which were not influenced significantly by the wall impedance changes. A.R.H.

N79-10843*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HELICOPTER ACOUSTICS, PART 2
Aug. 1978 438 p refs Presented at the Intern. Specialists Symp., Hampton, Va., 22-24 May 1978; sponsored by the Am. Helicopter Soc. and AROD
(NASA-CP-2052-Pt-2; L-12339-Pt-2) Avail: NTIS HC A19/MF A01 CSCL 20A

Exterior and interior helicopter noise problems are addressed from the physics and engineering as well as the human factors point of view. Noise regulation concepts, human factors and criteria, rotor noise generation and control, design, operations and testing for noise control, helicopter noise prediction, and research tools and measurements are covered. For individual titles, see N79-10844 through N79-10864.

N79-10844*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SUBJECTIVE EVALUATION OF HELICOPTER BLADE SLAP NOISE
William J. Galloway *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 403-418 refs (For primary document see N79-10843 01-71)
Avail: NTIS HC A19/MF A01 CSCL 20A

Several methods for adjusting EPNL to account for its underestimate of judged annoyance are applied to eight helicopter flyover noise signatures having various degrees of blade slap. A proposal for an impulsive noise correlation procedure based on a digital analysis of the flyover signal is investigated. When all data are combined, the proposal is little better than simply adding an arbitrary fixed adjustment of 3 decibels to EPNL. J.M.S.

N79-10845*# Westland Helicopters Ltd., Yeovil (England).
RATING HELICOPTER NOISE
John W. Leverton, B. J. Southwood, and A. C. Pike *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 419-438 refs (For primary document see N79-10843 01-71)
Avail: NTIS HC A19/MF A01 CSCL 20A

The effectiveness of the EPNL procedure in quantifying helicopter blade slap and tail rotor noise heard on approach some distance from the flyover position is addressed. Alternative methods of rating helicopter noise are reviewed including correction procedures to the EPNL concept which account for blade slap and tail rotor noise. The impact of the use of such corrections is examined. J.M.S.

N79-10846*# Societe Nationale Industrielle Aerospatiale, Paris (France).
ANNOYANCE OF HELICOPTER IMPULSIVE NOISE
F. Dambra and A. Damongeot *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 439-462 refs (For primary document see N79-10843 01-71)
Avail: NTIS HC A19/MF A01 CSCL 20A

Psychoacoustic studies of helicopter impulsive noise were conducted in order to qualify additional annoyance due to this feature and to develop physical impulsiveness descriptors to develop impulsivity correction methods. The currently proposed descriptors and methods of impulsiveness correction are compared using a multilinear regression analysis technique. It is shown that the presently recommended descriptor and correction method provides the best correlation with the subjective evaluations of real helicopter impulsive noises. The equipment necessary for data processing in order to apply the correction method is discussed. J.M.S.

N79-10847*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANNOYANCE DUE TO SIMULATED BLADE-SLAP NOISE
Clemans A. Powell *In its* Helicopter Acoustics, Pt. 2 Aug. 1978 p 463-477 refs (For primary document see N79-10843 01-71)
Avail: NTIS HC A19/MF A01 CSCL 20A

The effects of several characteristics of blade slap noise on annoyance response were studied. These characteristics or parameters were the sound pressure level of the continuous noise used to simulate helicopter broadband noise, the ratio of impulse peak to broadband noise or crest factor, the number of pressure excursions comprising an impulse event, the rise and fall time of the individual impulses, and the repetition frequency of the impulses. Analyses were conducted to determine the correlation between subjective response and various physical measures for the range of parameters studied. A small but significant improvement in the predictive ability of PNL was provided by an A-weighted crest factor correlation. No significant improvement in predictive ability was provided by a rate correction. J.M.S.

N79-10848*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HUMAN RESPONSE TO AIRCRAFT-NOISE-INDUCED BUILDING VIBRATION
Jimmy M. Cawthorn, Thomas K. Dempsey, and Richard BeLoach *In its* Helicopter Acoustics, Pt. 2 Aug. 1978 p 479-491 refs (For primary document see N79-10843 01-71)

Avail: NTIS HC A19/MF A01 CSCL 20A

The effects of noise induced building structure vibration and the rattle of objects on human response to aircraft flyover noise were investigated in a series of studies conducted in both the field and the laboratory. The subjective detection thresholds for vibration and rattle were determined as well as the effect of vibration and rattle upon aircraft noise annoyance. J.M.S.

N79-10849*# Boeing Vertol Co., Philadelphia, Pa.

A METHOD FOR DETERMINING INTERNAL NOISE CRITERIA BASED ON PRACTICAL SPEECH COMMUNICATION APPLIED TO HELICOPTERS

Harry Sternfeld, Jr. and Linda Bukowski Doyle *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 493-511 refs (For primary document see N79-10843 01-71)

(Contract DAAJ01-74-C-1054)

Avail: NTIS HC A19/MF A01 CSCL 20A

The relationship between the internal noise environment of helicopters and the ability of personnel to understand commands and instructions was studied. A test program was conducted to relate speech intelligibility to a standard measurement called Articulation Index. An acoustical simulator was used to provide noise environments typical of Army helicopters. Speech material (command sentences and phonetically balanced word lists) were presented at several voice levels in each helicopter environment. Recommended helicopter internal noise criteria, based on speech communication, were derived and the effectiveness of hearing protection devices were evaluated. J.M.S.

N79-10850*# Army Aeromedical Research Lab., Fort Rucker, Ala. Bioacoustics Div.

THE EFFECTIVE ACOUSTIC ENVIRONMENT OF HELICOPTER CREWMEN

Robert T. Camp, Jr. and Ben T. Mozo *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 513-517 (For primary document see N79-10843 01-71)

Avail: NTIS HC A19/MF A01 CSCL 20A

Methods of measuring the composite acoustic environment of helicopters in order to quantify the effective acoustic environment of the crewmen and to assess the real acoustic hazards of the personnel are examined. It is indicated that the attenuation characteristics of the helmets and hearing protectors and the variables of the physiology of the human ear be accounted for in determining the effective acoustic environment of Army helicopter crewmen as well as the acoustic hazards of voice communications systems noise. J.M.S.

N79-10851*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

THE EFFECT OF OPERATIONS ON THE GROUND NOISE FOOTPRINTS ASSOCIATED WITH A LARGE MULTIBLADED, NONBANGING HELICOPTER

David A. Hilton, Herbert R. Henderson, Domenic J. Maglieri, and William B. Bigler, II (Virginia Univ.) *In its* Helicopter Acoustics, Pt. 2 Aug. 1978 p 519-533 refs (For primary document see N79-10843 01-71)

Avail: NTIS HC A19/MF A01 CSCL 20A

In order to expand the data base of helicopter external noise characteristics, a flyover noise measurement program was conducted utilizing the NASA Civil Helicopter Research Aircraft. The remotely operated multiple array acoustics range (ROMAAR) and a 2560-m linear microphone array were utilized for the purpose of documenting the noise characteristics of the test helicopter during flyby and landing operations. By utilizing both ROMAAR concept and the linear array, the data necessary to plot the ground noise footprints and noise radiation patterns were obtained. Examples of the measured noise signature of the test helicopter, the ground noise footprint or contours, and the directivity patterns measured during level flyby and landing operations of a large, multibladed, nonbanging helicopter, the CH-53, are presented. J.M.S.

N79-10852*# Army Armament Research and Development Command, Aberdeen Proving Ground, Md.

A STATIC ACOUSTIC SIGNATURE SYSTEM FOR THE ANALYSIS OF DYNAMIC FLIGHT INFORMATION

Daniel J. Ramer *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 535-544 (For primary document see N79-10843 01-71)

Avail: NTIS HC A19/MF A01 CSCL 20A

The Army family of helicopters was analyzed to measure the polar octave band acoustic signature in various modes of flight. A static array of calibrated microphones was used to simultaneously acquire the signature and differential times required to mathematically position the aircraft in space. The signature was then reconstructed, mathematically normalized to a fixed radius around the aircraft. J.M.S.

N79-10853*# Southampton Univ. (England). Wolfson Unit for Noise and Vibration Control, ISVR.

AN ACTIVE NOISE REDUCTION SYSTEM FOR AIRCREW HELMETS

Peter D. Wheeler, David Rawlinson, Stephen F. Pelc, and Tony P. Dorey *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 545-550 refs (For primary document see N79-10843 01-71)

Avail: NTIS HC A19/MF A01 CSCL 20A

An active noise reduction system was developed for use in aircrew flying helmets in which the acoustic noise field inside the ear defender is detected using a miniature microphone and an antiphase signal is fed back to a communications telephone within the ear defender. Performance of the active noise reduction system in a laboratory trial simulating flight conditions is shown to be satisfactory. J.M.S.

N79-10854*# Boeing Vertol Co., Philadelphia, Pa.

DESIGN OF HELICOPTER ROTORS TO NOISE CONSTRAINTS

Edward G. Schaeffer and Harry Sternfeld, Jr. *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 551-561 refs (For primary document see N79-10843 01-71)

(Contract NAS1-15226)

Avail: NTIS HC A19/MF A01 CSCL 20A

Results of the initial phase of a research project to study the design constraints on helicopter noise are presented. These include the calculation of nonimpulsive rotor harmonic and broadband hover noise spectra, over a wide range of rotor design variables and the sensitivity of perceived noise level (PNL) to changes in rotor design parameters. The prediction methodology used correlated well with measured whirl tower data. Application of the predictions to variations in rotor design showed tip speed and thrust as having the most effect on changing PNL. J.M.S.

N79-10855*# Kaman Aerospace Corp., Bloomfield, Conn.

THE COST OF APPLYING CURRENT HELICOPTER EXTERNAL NOISE REDUCTION METHODS WHILE MAINTAINING REALISTIC VEHICLE PERFORMANCE

Michael A. Bowes *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 563-582 refs (For primary document see N79-10843 01-71)

(Contract DOT-FA76WA-3791)

Avail: NTIS HC A19/MF A01 CSCL 20A

Analytical methods were developed and/or adopted for calculating helicopter component noise, and these methods were incorporated into a unified total vehicle noise calculation model. Analytical methods were also developed for calculating the effects of noise reduction methodology on helicopter design, performance, and cost. These methods were used to calculate changes in noise, design, performance, and cost due to the incorporation of engine and main rotor noise reduction methods. All noise reduction techniques were evaluated in the context of an established mission performance criterion which included consideration of hovering ceiling, forward flight range/speed/payload, and rotor stall margin. The results indicate that small, but meaningful, reductions in helicopter noise can be obtained by treating the turbine engine exhaust duct. Furthermore, these reductions do not result in excessive life cycle cost penalties. Currently available main rotor noise reduction methodology, however, is shown to be inadequate and excessively costly. J.M.S.

N79-10856*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

HELICOPTER CABIN NOISE: METHODS OF SOURCE AND PATH IDENTIFICATION AND CHARACTERIZATION

Bruce S. Murray and John F. Wilby *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 583-594

ref (For primary document see N79-10843 01-71)
Avail: NTIS HC A19/MF A01 CSCL 20A

Internal noise sources in a helicopter are considered. These include propulsion machinery, comprising engine and transmission, and turbulent boundary layer effects. It is shown that by using relatively simple concepts together with careful experimental work it is possible to generate reliable data on which to base the design of high performance noise control treatments. J.M.S.

N79-10857*# Sikorsky Aircraft, Stratford, Conn.
A PRACTICAL APPROACH TO HELICOPTER INTERNAL NOISE PREDICTION
Larry S. Levine and Jon J. DeFelice *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 595-638 refs (For primary document see N79-10843 01-71)
Avail: NTIS HC A19/MF A01 CSCL 20A

A practical and well correlated procedure for predicting helicopter internal noise is presented. It accounts for the propagation of noise along multiple paths on an octave by octave basis. The method is sufficiently general to be applicable to conventional helicopters as well as other aircraft types, when the appropriate structural geometry, noise source strengths, and material acoustic properties are defined. A guide is provided for the prediction of various helicopter noise sources over a wide range of horsepower for use when measured data are not available. The method is applied to the prediction of the interior levels of the Civil Helicopter Research Aircraft (CHRA), both with and without soundproofing installed. Results include good correlation with measured levels and prediction of the speech interference level within 1.5 db at all conditions. A sample problem is also shown illustrating the use of the procedure. This example calculates the engine casing noise observed in the passenger cabin of the CHRA. J.M.S.

N79-10858*# Textron Bell Helicopter, Ft. Worth, Tex.
HELICOPTER INTERNAL NOISE CONTROL: THREE CASE HISTORIES
Bryan D. Edwards and Charlie R. Cox *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 639-656 (For primary document see N79-10843 01-71)
Avail: NTIS HC A19/MF A01 CSCL 20A

Case histories are described in which measurable improvements in the cabin noise environments of the Bell 214B, 206B, and 222 were realized. These case histories trace the noise control efforts followed in each vehicle. Among the design approaches considered, the addition of a fluid pulsation damper in a hydraulic system and the installation of elastomeric engine mounts are highlighted. It is concluded that substantial weight savings result when the major interior noise sources are controlled by design, both in altering the noise producing mechanism and interrupting the sound transmission paths. J.M.S.

N79-10859*# Kaman Aerospace Corp., Bloomfield, Conn.
AN ANALYTICAL METHOD FOR DESIGNING LOW NOISE HELICOPTER TRANSMISSIONS
Robert B. Bossler, Jr., Michael A. Bowes, and Allen C. Royal (Army Res. and Technol. Labs.) *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 657-677 refs (For primary document see N79-10843 01-71)
(Contract DAAJ02-74-C-0039)
Avail: NTIS HC A19/MF A01 CSCL 20A

The development and experimental validation of a method for analytically modeling the noise mechanism in the helicopter geared power transmission systems is described. This method can be used within the design process to predict interior noise levels and to investigate the noise reducing potential of alternative transmission design details. Examples are discussed. J.M.S.

N79-10860*# Westland Helicopters Ltd., Yeovil (England).
THE INFLUENCE OF THE NOISE ENVIRONMENT ON CREW COMMUNICATIONS
John W. Leverton *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 679-693 refs (For primary document see N79-10843 01-71)
Avail: NTIS HC A19/MF A01 CSCL 20A

The noise environment and how it affects crew communications in helicopters is considered. The signal to noise (S/N) ratio at the microphone and the effect of the attenuation provided by the helmet is discussed. This shows that the most important aspect is the S/N ratio at the microphone, particularly when helmets with improved attenuation characteristics are considered. Evidence is presented which shows that in high noise environments, the system S/N ratio is well below that required and hence there is an urgent need to reduce the cabin noise levels and improve the microphone rejection properties. Emphasis is placed on environmental/acoustic considerations. J.M.S.

N79-10861*# Societe Nationale Industrielle Aerospatiale, Paris (France).
HELICOPTER INTERNAL NOISE REDUCTION RESEARCH AND DEVELOPMENT APPLICATION TO THE SA 360 AND SA 365 DAUPHIN
H. J. Marze and F. Dambra *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 695-722 (For primary document see N79-10843 01-71)
Avail: NTIS HC A19/MF A01 CSCL 20A

Noise sources inside helicopter cabins are considered with emphasis on the mechanisms of vibration generation inside the main gear box and mechanisms of transmission between source and cabin. The dynamic behavior of the main gear box components is examined in relation to the transfer of vibration energy to the structure. It is indicated that although improvements can be made in noise reduction at the source, a soundproofing treatment isolating the passenger from the noise source is necessary. Soundproofing treatments installed and optimized include: (1) an acoustic screen using the weight effect to isolate the passenger from the noise source; (2) a damping treatment to limit the conversion of the vibratory energy into acoustic energy; and (3) an absorbing treatment achieved either through HELMHOLTZ resonators or through a glass wool blanket to limit the propagation of acoustic waves and the wave reflection effects in the cabin. The application of treatments at the source and the optimization of the sound barriers improved the noise level by about 30 db. J.M.S.

N79-10862*# Systems Research Labs., Inc., Dayton, Ohio. RASA Div.
THE STATUS OF ROTOR NOISE TECHNOLOGY: ONE MAN'S OPINION
Richard P. White, Jr. *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 723-780 refs (For primary document see N79-10843 01-71)
Avail: NTIS HC A19/MF A01 CSCL 20A

The problem of establishing the state of the technology is approached by first identifying the various characteristics of rotor noise and then assessing the state of technology in understanding and predicting the most important of these rotor noise characteristics in a real-world environment. J.M.S.

N79-10863*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
TRENDS IN LANGLEY HELICOPTER NOISE RESEARCH
Harvey H. Hubbard, Domenic J. Maglieri, and David G. Stephens *In its* Helicopter Acoustics, Pt. 2 Aug. 1978 p 781-796 refs (For primary document see N79-10843 01-71)
Avail: NTIS HC A19/MF A01 CSCL 20A

A broad perspective of needs in helicopter exterior and interior control is presented. Emphasis is given to those items which support noise certification of civil helicopters and which result in reduced environmental noise impact to community residents as well as to helicopter passengers. The activities described are related to the Langley responsibilities for helicopter acoustics as defined by NASA roles and missions. J.M.S.

N79-10864*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AEROACOUSTIC RESEARCH: AN ARMY PERSPECTIVE
H. Andrew Morse and Fredric H. Schmitz *In* NASA. Langley Res. Center Helicopter Acoustics, Pt. 2 Aug. 1978 p 797-817 refs Prepared in cooperation with Army Res. and Technol. Labs., Fort Eustis, Va. (For primary document see N79-10843 01-71)
Avail: NTIS HC A19/MF A01 CSCL 20A

A short perspective of the Army aeroacoustic research program is presented that emphasizes rotary wing, aerodynamically generated noise. Exciting breakthroughs in experimental techniques and facilities are reviewed which are helping build a

detailed understanding of helicopter external noise. Army and joint Army/NASA supported research programs in acoustics which promise to reduce the noise of future helicopters without severe performance penalties are included. J.M.S.

N79-10865# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE (SAW) DEVICES Quarterly Report, 1 Sep. 1977 - 28 Feb. 1978
L. Dyal Feb. 1978 43 p
(Contract DAAB07-75-C-0044)
(AD-A056840; QR-7) Avail: NTIS HC A03/MF A01 CSCL 17/1

The object of the program is the establishment of a production capability for surface acoustic wave devices of varied design and material for the purpose of meeting estimated military needs for a period of two years after the completion of the contract and to establish a base and plans which may be used to meet expanded requirements. The primary requirement is the pilot line production of devices that are reliable, reproducible, and low cost. This report describes the progress to date on the pilot line phase of the program. The degree of attention to detail has been adjusted upward from original planning to adequately report pricing and yield data and to ensure accuracy in the device performance evaluation. Solder sealing has recently been identified as a potential problem area in the manufacture of SAW devices and is being addressed. New solder seal methods are being developed and documented and an alternate approach of projection weld sealing is being investigated. Results of these investigations are reported. GRA

N79-10866# Science Applications, Inc., La Jolla, Calif.
ACOUSTIC PROPAGATION IN RANDOM OCEANS USING THE TRANSPORT EQUATION Final Report, 11 Jul. 1977 - 31 Jan. 1978
H. L. Wilson and F. D. Tappert 18 Apr. 1978 150 p refs
(Contract N00014-77-C-0583)
(AD-A057128; SAI-78-639-LJ) Avail: NTIS HC A07/MF A01 CSCL 20/1

The use of the transport equation for calculating acoustic propagation in a medium where rough surface and volume scattering effects are important has been investigated. The results of the study indicate that, for the surface duct considered, and at 1030 Hz, the below-duct ensonification can be ascribed to two effects. The first of these is scattering by a rough surface. No detailed surface roughness measurements were made during the acoustic propagation experiments that the calculations were compared with, but the study showed that even a very small swell component could account for much of the energy scattered below the duct. There was some ambiguity in exactly how to describe the surface roughness. A sawtooth model is used to account for both shadowing and multiple scatter. Preliminary comparisons of this model with a more realistic sinusoidal model suggest that little difference in the propagation results would have been observed had the sinusoidal model actually been used in the calculations. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N79-10867 North Texas State Univ., Denton.
A STUDY OF L-SHELL X-RAY PRODUCTION CROSS SECTIONS DUE TO H, He-4, AND Li-7 ION BOMBARDMENT TO SELECTED THIN RARE EARTH AND Pb TARGETS Ph.D. Thesis
Glenn Michael Light 1978 114 p
Avail: Univ. Microfilms Order No. 7816725

Thin target L-Shell X ray production cross sections for protons incident on Sm and Yb in the energy range of 0.3 to 2.4 MeV/amu, alpha particles incident on Sm, Yb, and Pb in the energy range of 0.15 to 4.8 MeV/amu, and lithium ions incident on Ce, Nd, Sm, Dy, Ho, Yb, and Pb in the energy range of 0.8 to 4.4 MeV/amu were measured. The cross section data were compared to the planewave Born approximation (PWBA) and the PWBA modified to include binding energy and Coulomb deflection effects. Dissert. Abstr.

N79-10868 Columbia Univ., New York.
EXCITED-STATE, TRI-LEVEL, AND TWO-PHOTON ECHOES IN ATOMIC SODIUM VAPOR Ph.D. Thesis
Thomas William Mossberg 1978 228 p
Avail: Univ. Microfilms Order No. 7819401

A formalism is presented for use in predicting and describing new and previously unexpected echo effects in two-(or three-) level systems as well as being capable of describing the echo effects already known. Three categories of experiments are described. The first, in which excited-state photon echoes were first observed and applied to relaxation measurements, represents an extension of a previously well-known effect, the photon echo. The second, which marks the first observation of tri-level echoes, demonstrates that there are many rephasing phenomena which have heretofore gone unexpected. The third, in which two-photon echoes were first observed, represents the observation of an effect which has been long expected. Dissert. Abstr.

N79-10869 Illinois Univ. at Chicago Circle, Chicago.
APPLICATIONS OF CLASSICAL SCATTERING THEORY TO REACTIVE AND NON-REACTIVE SYSTEMS: ATOM OR ATOMIC ION AND LINEAR MOLECULE COLLISIONS Ph.D. Thesis
Judith Grobe Sachs 1978 161 p
Avail: Univ. Microfilms Order No. 7818207

Classical perturbation scattering theory was applied to the determination of cross sections resulting from ion-dipole scattering and to a study of angular momentum transfer during scattering using various model potentials. A method for expanding differential cross sections in Legendre polynomials was developed and applied to both reactive and non-reactive scattering problems. This expansion method can give a good fit to the cross section using relatively few trajectories, and is generally superior to the commonly used histogram procedure. The problem of excessive noise in the expansion is easily remedied by simple averaging techniques. Modifications to the harpoon model of reactive scattering which allow this simple theory to calculate reactive cross sections are presented. Dissert. Abstr.

N79-10870# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
QUASI-PARTICLE ENERGY OF THE HUBBARD MODEL IN THE WEAK CORRELATION REGIME
K. A. Chao, R. Kishore, and I. C. daCunhaLima Aug. 1978 13 p refs
(INPE-1347-PE/164) Avail: NTIS HC A02/MF A01

The Fedro-Wilson theory to obtain a hierarchy of differential equations for the correlation functions was studied. An approximation is suggested for the truncation of the hierarchy of equations. The result is applied to the weakly correlated Hubbard model to calculate the quasi-particle energy. G.G.

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N79-10871 Carnegie-Mellon Univ., Pittsburgh, Pa.
LOW-ENERGY PION SCATTERING Ph.D. Thesis
Steven Allen Dytman 1978 156 p
Avail: Univ. Microfilms Order No. 7815198

Methods and results are described for scattering of 50 MeV positive pions from carbon, oxygen, silicon and iron. This includes elastic and inelastic differential cross sections; states studied are 2(+)(4.44 MeV) and 3(-)(9.64) in C-12, 2(+)(1.78) in Si-28, and 2(+)(0.85) and 3(-)(4.51) in Fe-56. The EPICS beam line at LAMPF was used with a solid state detector system. A spectrometer of two stacked high purity germanium crystals

was developed for this experiment. With excellent resolution (less than 0.5%) and particle identification, this proved to be a very useful method. Dissert. Abstr.

N79-10872 Cornell Univ., Ithaca, N. Y.
ANALYSIS OF THE FOUR PION EXCLUSIVE CHANNEL IN INELASTIC ELECTRON-PROTON SCATTERING Ph.D. Thesis
Thomas Joseph Killian 1978 141 p
Avail: Univ. Microfilms Order No. 7817832

Data from a large aperture magnet experiment are presented that were taken by 12 GeV electron synchrotron. Events consisting of a scattered electron, proton, and four pions in the final state are investigated, with attention paid to possible resonances in the pion system. The overall computer analysis of the experiment is discussed. Dissert. Abstr.

N79-10873# Brookhaven National Lab., Upton, N. Y. Dept. of Accelerators.
PROPOSAL FOR A BOOSTER TO RAISE THE INJECTION ENERGY OF THE AGS
T. F. Kycia and M. Month 14 Feb. 1978 8 p
(Contract EX-76-C-02-0016)
(BNL-50805) Avail: NTIS HC A02/MF A01

Benefits to be derived from inserting a small circumference energy booster between the 200 MeV Linac and the alternating gradient synchrotron (AGS) include an increase in protons on target for the nu program, an increase in anti p flux, an increase in AGS operationaly reliability, and an increase in beam b rightness for ISABELLE. More significantly, it could allow rapid current accumulation for ISABELLE with reduced aperture requirement thus avoiding the complexities associated with the present RF stacking approach. The existing princeton-Penn accelerator is proposed an ideal booster for the AGS complex. To obtain high brightness beams as well as intense beams, it appears to be necessary to shift to H(-) injection from the Linac to the booster. In this way, it is conceivable that approximately 10 to the 14th power protons per AGS pulse could become a reality. DOE

N79-10874# Department of Energy, Washington, D. C. Div. of High Energy and Nuclear Physics.
SUMMARIES OF FISCAL YEAR 1977, RESEARCH IN HIGH ENERGY PHYSICS
Oct. 1977 258 p
(DOE/ER-0014) Avail: NTIS HC A12/MF A01

Experimental and theoretical investigations on the properties, structure and transformation of matter and energy in their most basic forms are surveyed. The scope and nature of high energy physics research presently funded by the U.S. Department of Energy is summarized. The areas covered include conception, design, construction, and operation of particle accelerators; experimental research using the accelerators and ancillary equipment; theoretical research; and research and development programs to advance accelerator technology, particle detector systems, and data analysis capabilities. DOE

N79-10875# Cincinnati Univ., Ohio.
INELASTIC STRONG INTERACTIONS AT HIGH ENERGIES
P. Suranyi 20 Oct. 1977 9 p refs
(Contract EY-76-S-02-2978)
(COO-2978-2) Avail: NTIS HC A02/MF A01

A method permitting the calculation of inclusive and semi-inclusive cross section at high energies starting from an arbitrary field theory was developed. The method relies on a functional integral representation of the generating functional of inclusive cross sections and on the use of semiclassical methods. The inclusive cross section is proportional to the absolute square of the Fourier transform of a special soliton solution of the classical field equations in zeroth order semi-classical approximation. A conserved topological quantum number that has a nonzero value for the soliton solution was found. Future research to be performed in this field under the contract is described including applications to various field theories and the exploration of connections with Reggeon field theory. DOE

74 OPTICS

Includes light phenomena.

N79-10876 California Inst. of Tech., Pasadena.
NEW OPTOELECTRONIC DEVICES USING GaAs-GaAlAs EPITAXY Ph.D. Thesis
Chien-Ping Lee 1978 199 p
Avail: Univ. Microfilms Order No. 7816952

The selective multilayer growth of GaAs-GaAs-GaAlAs single crystal structures through stripe openings in making layers on GaAs substrates results in prismatic layers of GaAs and GaAlAs embedded in each other and leads to controllable uniform structures terminated by crystal faces. By using potential barriers in the base regions, GaAs-GaAlAs heterostructure PNPN laser diodes were fabricated, and PNPN lasers with low threshold currents and high breakover voltage were achieved. Crowding effect lasers and lateral injection lasers are discussed. An integrated device, which consists of a crowding effect laser and a Gunn oscillator on a common semi-insulating GaAs substrate, is described. Dissert. Abstr.

N79-10877 West Virginia Univ., Morgantown.
THE ANGER GAMMA CAMERA POINT SPREAD FUNCTION: CALCULATION AND APPLICATIONS Ph.D. Thesis
Robert Karl Tyson 1978 171 p
Avail: Univ. Microfilms Order No. 7817008

By integrating the orders of scattering solution to the photon transport equation over limits determined by the geometry of the collimator, expressions are found for the point spread function with variable parameters corresponding to the physical variables of the system. Line spread functions are calculated from the point spread functions and compared to measured line spread functions to verify the accuracy of the PSF expressions. By solving convolution integrals, with a detailed discussion of geometrical and anatomical objects and object sampling criteria, simulated images are made on a digital computer to illustrate the image formation process and the effects of collimator focusing. By extending the image simulation methods to include non-uniform radio-nuclide concentration, the process where one can arbitrarily vary that concentration is presented in terms of an aid to teaching diagnosticians. Dissert. Abstr.

N79-10878 Rochester Univ., N. Y.
THEORETICAL AND EXPERIMENTAL STUDIES ON THE IMPORTANCE OF PHOTOGRAPHIC GRAIN IN OPTICAL SYSTEMS Ph.D. Thesis
Scott Arthur Armstrong 1978 186 p
Avail: Univ. Microfilms Order No. 7818244

The importance of photographic grain in image processing is discussed; current techniques that deal with this program are outlined. The unsuitability of the standard linear technique (Wiener filter) for dealing with the non-stationarity of the photographic grain is shown. An alternative nonlinear, space domain tecchnique (noise-cheating) is discussed and possible modifications of it are suggested. Possible applications of the results to image analysis and image processing are described. Dissert. Abstr.

N79-10879# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UNSTABLE STRIP RESONATORS WITH MISALIGNED CIRCULAR MIRRORS
Carlos Eduardo Santana and L. B. Felsen (Polytechnic Inst. of New York, Farmingdale) Oct. 1977 35 p refs
(Grant AF-AFOSR-3192-77)
(INPE-1134-PE/096) Avail: NTIS HC A03/MF A01

The waveguide approach was applied to unstable strip resonators with unequal sharp-edged circular mirrors that were tilted with respect to the resonator axis. An equivalent resonator with nontilted mirrors is defined where the mirror edges form asymmetrically placed terminations of the open-ended transverse waveguide. The eigenmode losses were found by calculating the waveguide mode reflection coefficients for each pair of edges and inserting these into the resonance equation. Numerical calculations for the low-loss detached mode are presented for the special case of symmetrical resonators. Results show that misalignment introduces additional ripples into the power loss

vs. Fresnel number curves. A ray-optical interpretation in terms of edge diffraction is shown to account for this behavior. S.B.S.

N79-10880# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EDGE DETECTION IN IMAGES: A HYPOTHESIS TESTING APPROACH
Nelson D. A. Mascarenhas and Lucila O. C. Prado Feb. 1978 26 p refs
(INPE-1194-PE/111) Avail: NTIS HC A03/MF A01

New statistical techniques for the edge detection problem in images are developed. The image is modeled by signal and noise which are independent, additive, Gaussian and autorregressive in two dimensions. The optimal solution, in terms of statistical decision theory, leads to a test which decides among multiple, composite, overlapping hypotheses. A computationally attractive suboptimal test, involving non-overlapping hypotheses, is proposed. Results are presented with simulated data and real satellite images. A comparison with standard gradient techniques is made. Author

N79-10881*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHOTON REFLECTION AT THE BOUNDARY OF AN INVERTED MEDIUM
Nabil M. Lawandy Aug. 1978 13 p refs Submitted for publication
(NASA-TM-79610; G-7802-18) Avail: NTIS HC A02/MF A01 CSCL 20F

The index change near a quantum transition is shown to cause significant feedback into a gain medium. Criteria are given for the onset of self-lasing in an extended material. The distortion of a reflected pulse is also considered. Author

N79-10882# White Sands Missile Range, N.Mex.
NOVEL CONCEPTS IN REAL-TIME OPTICAL TRACKING
Alton L. Gilbert and Michael K. Giles Jun. 1978 15 p refs
(AD-A056440) Avail: NTIS HC A02/MF A01 CSCL 17/8

Optical tracking has been a mainstay of accurate metric range instrumentation since the first testing of modern rocketry. The accuracies that were possible from optical instruments exceeded those from other available instruments. Improvements in encoders, optical testing, modelling of the atmosphere, and optical design continuously improved the accuracies of optical instruments. The major drawback is the required film processing which delayed the delivery of boresight corrected optical data. Recent changes in technology have created the potential for relieving part of the delay in data delivery. Automatic tracking methods using high-speed microprocessors, artificial intelligence, and pattern recognition techniques, together with special modifications to the existing optical systems, are now available to perform most of the film reading function in an on-line, real-time mode. These methods far exceed the conventional contrast, edge, and correlation trackers in sophistication and capability, since they are based upon an understanding of some definable properties of the image involving many parameters as compared to only a few. GRA

N79-10883# California Univ., Irvine. School of Engineering.
OPTICAL TRANSMISSION THROUGH THE TURBULENT ATMOSPHERE Final Scientific Report, 1 Oct. 1976 - 31 Jan. 1978
Hideya Gamo 30 Mar. 1978 65 p refs
(Grant AF-AFOSR-3097-76; AF Proj. 2310)
(AD-A056746; AFOSR-78-1215TR) Avail: NTIS HC A04/MF A01 CSCL 20/6

A turbulence chamber (0.78 m x 0.23 m x 2.59 m) consisting of 10 small electric heater/blowers with 2 mm aluminum wire meshes can generate the nearly homogeneous isotropic turbulence with the region of 0.5 m x 0.05 m x 2 m. The temperature structure constant was obtained from the temperature structure function measurements using a differential microthermocouple system. The refractive index structure constant was calculated from the temperature structure constant at the average temperature 53 C. From the measured power spectrum of temperature fluctuations and the average wind velocity 0.41 m/sec it was determined that the inner and outer scales of turbulence l sub 0 = 5.0 nm and L sub 0 = 6.5 cm, respectively. The measured temperature structures fluctuations satisfy the 2/3 and -5/3 power similarity laws, characteristics of the inertial subrange, respectively. GRA

N79-10884# Army Electronics Research and Development Command, Ft. Belvoir, Va. Night Vision and Electro-Optics Labs.
FLIR IMAGE ENHANCEMENT BY AUTOMATIC LOW FREQUENCY GAIN LIMITING
Sen-Te Chow and John J. Pupich Jun. 1978 14 p
(AD-A056420) Avail: NTIS HC A02/MF A01 CSCL 17/5

An inherent problem with existing Military FLIR Common Module systems is that the dynamic range of the thermal scenes far exceeds that of the system display. Current displays used in FLIR systems have a dynamic range of approximately 30 db (32:1) and typical infrared scenes can be several orders of magnitude greater. A common example being the terrain-sky horizon which an airborne FLIR encounters when the helicopter or aircraft makes a steep bank. In this scenario some of the channels in the vertical array of detectors will be viewing both the hot terrain and cold sky. This scene dynamic range can be as high as 500 to 1, or 54 db, with a temperature difference, delta T of 100 C and the noise equivalent differential temperature (NE delta T) of 0.2 C. The display of the channels will be such that the terrain saturates to white and the sky is suppressed to black, assuming that the system polarity switch is in the white/hot mode. Now if the operator attempts to reduce the gain of the system, such that both areas are within the dynamic range of the display, he is unable to perceive detail in both regions due to a lack of contrast. At this moment the operator may adjust the brightness level and maintain the contrast high enough to perceive either the terrain or the sky detail but not both simultaneously. GRA

N79-10885# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
MIE THEORY SENSITIVITY STUDIES. THE EFFECTS OF AEROSOL COMPLEX REFRACTIVE INDEX AND SIZE DISTRIBUTION VARIATIONS ON EXTINCTION AND ABSORPTION COEFFICIENTS. PART 2: ANALYSIS OF THE COMPUTATIONAL RESULTS
S. G. Jennings and J. B. Gillespie Mar. 1978 93 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A057077; ERADCOM/ASL-TR-0003-Pt-2) Avail: NTIS HC A05/MF A01 CSCL 20/6

A comprehensive study has been made of the effect of the complex index of refraction and particle size distribution on the volume extinction and absorption coefficients. Calculations were performed by use of a generalized Mie scattering program for lognormal particle size distributions over a range of geometric mean radius r sub g from 0.005 to 10 micrometers and geometric standard deviation sigma sub g from 1.0 up to 2.5. The results are normalized to a total particle mass loading of 100 micrograms cu cm and a particle density of 2.5 g/cu cm. The computations were made at wavelength lambda of 0.55, 0.6943, 1.06, 3.8 and 10.6 micrometers, for a range of imaginary index k from 0.001 to 6.0 and a range of real index n from 0.1 up to 6.5. GRA

N79-10886# Los Alamos Scientific Lab., N. Mex.
SECTIONING IN IMAGE PROCESSING
H. J. Trussell 1977 7 p refs Presented at the Digital Signal Process. Symp., Albuquerque, N. Mex., 6 Dec. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2590; Conf-771206-16) Avail: NTIS HC A02/MF A01

For reasons of mathematical tractability, simplifying assumptions are made about the statistical nature of images that are to be processed. Among these assumptions are stationarity of the signal and noise processes and the space invariance of the blur. These assumptions rarely hold over a large image, but can be considered accurate over small subsections of an image. With this idea in mind, it is natural to divide an image into small, possibly overlapping, sections and process each section with consideration to its peculiar characteristics. This technique was used with success on problems involving iterative numerical image restorations, signal-dependent noise, and space-variant point spread functions. DOE

N79-10887# Los Alamos Scientific Lab., N. Mex.
UNIFORMLY REDUNDANT ARRAYS
E. E. Fenimore and T. M. Cannon 1977 15 p refs Presented at Digital Signal Processing Symp., Albuquerque, N. Mex., 6 Dec. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2683; Conf-771206-22) Avail: NTIS HC A02/MF A01

A recent development in coded aperture imaging removed the basic limitation on the quality of the reconstructed images when a correlation analysis is used. A pattern of holes for the aperture was designed that has an autocorrelation that is perfectly flat. The pattern is referred to as a uniformly redundant array (URA) and combines the high-transmission characteristics of the random arrays and Fresnel zone plate with the flat sidelobe advantage of the nonredundant pinhole array. An analysis procedure was developed (balanced correlation) that, when combined with the URA, gives a system point-spread function which is exactly a delta function. Computer simulations were used to demonstrate that, with random arrays, the balanced correlation is able to improve the reconstructed images by orders of magnitude. Additional orders of magnitude improvement are possible if the URA pattern is used. DOE

N79-10888# National Technical Information Service, Springfield, Va.
LIGHT COMMUNICATION SYSTEMS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jun. 1976 - Jun. 1978
William E. Reed Aug. 1978 238 p Supersedes NTIS/PS-77/0591; NTIS/PS-76/0511; NTIS/PS-75/412
(NTIS/PS-78/0873/6; NTIS/PS-77/0591; NTIS/PS-76/0511; NTIS/PS-75/412) Avail: NTIS HC $28.00/MF $28.00 CSCL 17B

The design, performance, and application of laser, infrared, and visual communication systems are covered in the cited research reports. Transmission and equipment studies for space, atmospheric, and underwater light communication are presented. Topics covered include lasers, fiber optics, signal processing, transmission links, and data transmission. This updated bibliography contains 231 abstracts, 87 of which are new entries to the previous edition. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N79-10889 Polytechnic Inst. of New York.
EVOLUTION OF TRANSVERSE INSTABILITY IN A HOLLOW CYLINDRICAL WEAKLY-IONIZED PLASMA COLUMN Ph.D. Thesis
Hirayr Mihran Kudyan 1978 149 p
Avail: Univ. Microfilms Order No. 7816755

The formation of striations (i.e., bunching of plasma in the azimuthal direction) is predicted by an approximate nonlinear model in which the wave-supporting plasma boundaries and the bulk of the plasma are regarded as two individual systems. The boundaries are assumed to be always uniform in the azimuthal direction, while the bulk plasma is assumed to be always uniform in the radial direction. However, the two systems communicate via the electric fields. Thus, initially the field of the surface waves is seen as stationary at the internal charge layers, which respond to it by bunching. This bunching in turn generates an azimuthal electric field, which at the location of the boundaries is slightly out of phase with respect to the field of the surface waves. As bunching goes on, the two interacting waves lose synchronism and their linear growth is eventually quenched by this mechanism. Dissert. Abstr.

N79-10890 California Univ., Davis.
GUIDING CENTER SIMULATIONS OF STRONG ION BEAMS WITH APPLICATIONS TO THE COUNTER STREAMING ION TORUS Ph.D. Thesis
Carol Griswold Tull 1978 213 p
Avail: Univ. Microfilms Order No. 7815522

In the proposed Counterstreaming Ion Torus (CIT) steady state rather than pulsed operation may be possible if all of the plasma power density is provided by neutral beam injection. After the neutral beams have penetrated the magnetic field, strong ion beam currents are produced. A major concern with the relatively strong counterstreaming ion currents is the effect of the beam self-magnetic fields on the macroscopic equilibrium of the system. Pinching and self focusing of the individual beams may occur, or the repulsive interaction of the two oppositely directed beam currents may destroy the equilibrium entirely. This macroscopic behavior of the ion beams is investigated with a guiding center plasma particle simulation model. A model is described that was developed to simulate steady state behavior in an ideal CIT configuration. Dissert. Abstr.

N79-10891 California Univ., Davis.
LOW FREQUENCY GEOMETRIC RESONANT HEATING Ph.D. Thesis
Reagan Wentworth Moore 1978 153 p
Avail: Univ. Microfilms Order No. 7814989

In the ideal magnetohydrodynamic approximation, heating may occur at either the cusp mode or the Alfven mode. When non-fluid pressure effects are included by the use of guiding center theory, the requirements for appreciable heating at the cusp mode are changed. The limitations for the validity of the guiding center description of the slow magnetosonic wave are found from consideration of finite Larmor radius effects. Energy heating rate expressions are calculated and applied numerically by solving the guiding center equation for the plasma displacement with the Galerkin formulation of the finite element method. Requirements for appreciable heating at the cusp mode are found, and heating at the cusp mode and at the Alfven mode is compared. While the Alfven mode heating gives a higher heating rate, the heating at the cusp mode is much broader and provides a way to shape plasma pressure profiles. Dissert. Abstr.

N79-10892 California Univ., Irvine.
HIGH-DENSITY Z-PINCH Ph.D. Thesis
Joseph Haim Shiloh 1978 224 p
Avail: Univ. Microfilms Order No. 7819058

A zeta pinch-produced high density plasma, in which a jet of gas was injected in between two electrodes prior to the discharge was studied. The injection was achieved with the use of a fast gas valve. Both solid and hollow jets were tried in conjunction with 1.3 and 15 kJ capacitor banks. Advantages of this scheme towards the production of high density plasmas as well as the scaling up of the input energy are discussed, and its properties are compared to other related experiments. A broad range of diagnostics was developed and employed, including a fast interferometer using a nitrogen laser as a light source, visible light fast photography, detailed X-ray spectroscopy, X-ray pinhole photography, hard X-ray detection, energetic ion detection, neutron measurements. The density profile as a function of time during the implosion stage was studied using laser diagnostics and fast photography. Dissert. Abstr.

N79-10893 Rochester Univ., N. Y.
THEORY OF RESONANT ABSORPTION Ph.D. Thesis
Thomas Speziale 1978 141 p
Avail: Univ. Microfilms Order No. 7818291

Analytic solutions to the problem of linear wave conversion in an unmagnetized, collisionless plasma were obtained for nearly all angles of incidence. A simple equation describing the generation of the quasi-steady magnetic field by resonant absorption in a cold, collisionless plasma is derived. The explicit time behavior of the high frequency fields due to resonant absorption is ascertained. These fields are employed to obtain a fully analytic expression for the quasiy steady magnetic field. Expressions are presented for the saturated magnetic field based on saturation times for the high frequency fields appropriate to plasma wave convection or wavebreaking. Modifications of the magnetic field structure due to plasma wave propagation are calculated and the magnetic field is seen to convect with the plasma wave. The resonant absorption of laser radiation normally incident onto a magnetized plasma is examined. Dissert. Abstr.

N79-10894*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYDROGEN HOLLOW CATHODE ION SOURCE Patent Application
M. Mirtich, J. Sovey, and R. Roman, inventors (to NASA) 23 Oct. 1978 8 p
(NASA-Case-LEW-12940-1; US-Patent-Appl-SN-953391) Avail: NTIS HC A02/MF A01 CSCL 20I

A hydrogen source is disclosed which includes a chamber having at one end a cathode which provides electrons and through which hydrogen gas flows into the chamber. Screen and accelerator grids are provided at the other end of the chamber. A baffle plate is placed between the cathode and the grids, and a cylindrical baffle is disposed coaxially with the cathode at the one end of the chamber. The cylindrical baffle is of greater diameter than the baffle plate to provide discharge impedance and also to protect the cathode from ion flux. An anode electrode draws the electrons away from the cathode. The hollow cathode includes a tubular insert of tungsten impregnated with a low work function material to provide ample electrons. A heater is provided around the hollow cathode to initiate electron emission from the low work function material. The source provides hydrogen or deuterium ions at a beam current density exceeding 0.1 amperes (A)/sq cm and has a discharge current which can exceed 100A for duty cycles of several minutes. NASA

N79-10895*# Illinois Univ., Urbana.
EVALUATION OF PERFORMANCE OF SELECT FUSION EXPERIMENTS AND PROJECTED REACTORS Final Report
George H. Miley Oct. 1978 31 p refs
(NASA Order C-2438-D)
(NASA-CR-3043) Avail: NTIS HC A03/MF A01 CSCL 20I

The performance of NASA Lewis fusion experiments (SUMMA and Bumpy Torus) is compared with other experiments and that necessary for a power reactor. Key parameters cited are gain (fusion power/input power) and the time average fusion power, both of which may be more significant for real fusion reactors than the commonly used Lawson parameter. The NASA devices are over 10 orders of magnitude below the required powerplant values in both gain and time average power. The best experiments elsewhere are also as much as 4 to 5 orders of magnitude low. However, the NASA experiments compare favorably with other alternate approaches that have received less funding than the mainline experiments. The steady-state character and efficiency of plasma heating are strong advantages of the NASA approach. The problem, though, is to move ahead to experiments of sufficient size to advance in gain and average power parameters. Author

N79-10896# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DYNAMIC SHEAR STABILIZATION OF HYDROMAGNETIC KINK INSTABILITIES IN PINCH AND/OR TOKAMAK PLASMA THROUGH A NONLINEAR MODE COUPLING
Kazuo Minami, Hiroshi Hata, and Shiro Dagiri Sep. 1978 37 p refs
(IPPJ-353) Avail: NTIS HC A03/MF A01

Dynamic shear stabilization is analyzed from the standpoint of a nonlinear mode coupling between the kink mode and an applied helical RF magnetic field. The analysis is limited to the case of the m = 1 kink mode with long wavelengths in a uniform plasma column with sharp boundary. The dispersion relation of the kink mode in the presence of a small-amplitude helical RF magnetic field is derived. Results suggests that dynamic shear stabilization can be more effective than the prediction of the Mathieu equation. S.B.S.

N79-10897# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DYNAMIC SHEAR STABILIZATION OF HYDROMAGNETIC INSTABILITIES IN LOW-BETA PLASMA COLUMN BY A FREQUENCY NEAR THE ION CYCLOTRON FREQUENCY
Kazuo Minami and Kazunori Sato Sep. 1978 14 p refs
(IPPJ-354) Avail: NTIS HC A02/MF A01

The effectiveness of an axial RF current, whose frequency is not much smaller than the ion cyclotron frequency, on the dynamic shear stabilization of the hydromagnetic instability in low-beta plasmas was analyzed, using the simple model of a uniform plasma column with infinite conductivity. Attention was limited to the case of the m = 1 kink model with long wave lengths. The Mathieu equation, in which the effect of the ion cyclotron motion is taken into account, was derived. It is shown that the dynamic shear stabilization is still effective, even if the frequency of the applied RF current is of the order of the ion cyclotron frequency, which is considerably higher than the frequencies believed to be available in the previous analyses. A.R.H.

N79-10898# Nagoya Univ. (Japan). Inst. of Plasma Physics.
TWO COMPONENT PLASMA VORTEX APPROACH TO FUSION
Kazunari Ikuta Sep. 1978 14 p refs
(IPPJ-355) Avail: NTIS HC A02/MF A01

Two component operations of the field reversed theta pinch plasma by injection of the energetic ion beam with energy of the order of 1 MeV is considered. A possible trapping scheme of the ion beam in the plasma is discussed in detail. Author

N79-10899# Nagoya Univ. (Japan). Inst. of Plasma Physics.
INITIAL PARTICLE LOADINGS FOR A NONUNIFORM SIMULATION PLASMA IN A MAGNETIC FIELD
Hiroshi Naitou, Sinji Tokuda, and Tetsuo Kamimura Sep. 1978 33 p refs
(IPPJ-356) Avail: NTIS HC A03/MF A01

Improved methods for initially loading particles in a magnetized simulation plasma with nonuniform density and temperature distributions are proposed. In the usual guiding center loading, a charge separation coming from finite Larmor radius effects remains due to the difference between the guiding center density and the actual density. The modified guiding center loading presented here eliminates the electric field so generated and can be used for arbitrary density and temperature profiles. Some applications of these methods to actual simulations are given for comparison. The significance of these methods of initial particle loadings is also discussed. Author

N79-10900# Nagoya Univ. (Japan).
INSTITUTE OF PLASMA PHYSICS Annual Review, Apr. 1977 - Mar. 1978
1978 185 p refs
Avail: NTIS HC A09/MF A01

The construction and successful operations of the RFC-XX, the SPAC-V toroidal device, the Phoebus II electron beam generator, and the Nagoya bumpy torus are reported. Research activities discussed include radio frequency confinement, high beta pinch plasmas, high energy beam experiments, atomic processes, technology and applied physics, plasma theory and computations, plasma diagnostics, and on-line systems. Common centers for processing and storing plasma physics and nuclear fusion data are described, as well as the MVA flywheel power supply facility. A.R.H.

N79-10901# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THOMSON SCATTERING MEASUREMENT IN JIPP T-II DEVICE
K. Kawahata, Y. Hamada, A. Yasuda, and K. Miyamoto Jul. 1978 23 p refs
(IPPJ-352) Avail: NTIS HC A02/MF A01

Measurements of electron temperature and density in J.I.P.P. T-II device were made by Thomson scattering of ruby laser light. It was found that the plasmas of electron temperature in the range of 0.5 to 1.3 keV and of electron density in the range of 1.5 to 10 x 1013/cc were confined. The overall layout of laser measurement system used in J.I.P.P. T-II device and the examples of the measurements are described. Author

N79-10902# California Univ., Los Angeles. Plasma Physics Group.
EXCITATION OF LOWER HYBRID WAVES IN A FINITE PLASMA Ph.D. Thesis
V. K. Decyk, J. M. Dawson, and G. J. Morales Feb. 1978 44 p refs
(Contracts N00014-75-C-0476; EY-76-C-03-0010)
(AD-A056844; PPG-338) Avail: NTIS HC A03/MF A01 CSCL 20/9

A computer simulation study of the launching of lower hybrid waves by external sources and their propagation in a finite but homogeneous plasma slab is presented. The study makes use

of a 2-1/2 dimensional, electrostatic particle code developed for simulation of bounded plasma. A number of antenna configurations are considered: a point source, two finite-length capacitor plates, and a phased array of capacitor plates. When the oscillating frequency does not match a bounded plasma resonance, one can observe resonance cones, energy absorption at the plasma surface, ion cyclotron modulation of the source, and energetic ions, depending on the parameters chosen. The excitation of a bounded plasma resonance is also considered. The nonlinear evolution of the resonance shows that wave-particle interactions and ponderomotive force effects play an important role. The possibility of controlling the electron temperature profile is discussed. Author (GRA)

N79-10903# Indiana Univ. at Bloomington. Dept. of Chemistry.
INVESTIGATION INTO THE OPERATING CHARACTERISTICS OF A MICROARC ATMOSPHERIC-PRESSURE GLOW DISCHARGE
R. I. Bystroff, L. R. Layman, and G. M. Hieftje 24 Jul. 1978 28 p refs
(Contract N00014-76-C-0838)
(AD-A056954; TR-14) Avail: NTIS HC A03/MF A01 CSCL 07/4

Details of the processes occurring during sample atomization from a 'microarc' discharge have been studied photometrically, by use of high-speed color cinematography and through current-voltage waveforms. The 'microarc' studied here is an atmospheric pressure inert gas glow discharge supported between 0.25 mm diameter tungsten wires; quiescent argon-1% H2 provides reactive-sputtering conditions and improved behavior in the presence of oxygen impurities. GRA

N79-10904# Science Applications, Inc., La Jolla, Calif.
ASSESSMENT OF THE TOKAMAK CONFINEMENT DATA BASE Final Report
R. E. Aamodt, R. N. Byrne, H. Fleischmann, K. W. Gentle, N. A. Krall, R. J. Taylor, and A. W. Trivelpiece Mar. 1978 119 p refs Sponsored by EPRI
(EPRI-ER-714) Avail: NTIS HC A06/MF A01

The results of an early 1977 survey of the Tokamak physics data base are discussed. The important Tokamak physics characteristics necessary for developing a fusion reactor were identified. An overview of the state of the present Tokamak fusion reactor program was given, and suggestions on the expansion of the data base were discussed. The mirror fusion reactor program is included. DOE

N79-10905# Los Alamos Scientific Lab., N. Mex.
SUMMARY OF SYLLAC RESULTS
R. E. Siemon Apr. 1978 29 p refs
(Contract W-7405-eng-36)
(LA-7125-MS) Avail: NTIS HC A03/MF A01

A series of theta-pinch high-beta stellarator experiments were completed. The existence of a toroidal equilibrium at high beta (about 70 percent) is revealed and the expected instability of gross plasma motion is demonstrated. Feedback stabilization, by means of optical sensors for plasma position coupled to current amplifiers for magnetic field control, works effectively to keep the plasma column near the center of the discharge vessel is given. Confinement of plasma in the recent feedback experiments is limited by classical end losses associated with the finite-length toroidal sectors. A simplified history of Scyllac much as it was presented in an invited paper at the 1977 Plasma Physics Division meeting of the American Physical Society held in Atlanta, Georgia is presented. DOE

N79-10906# California Univ., Livermore. Lawrence Livermore Lab.
SUB-keV, SUBNANOSECOND MEASUREMENTS OF X-RAY SPECTRA FROM LASER-PRODUCED PLASMAS
H. N. Kornblum, L. N. Koppel, V. W. Livinsky, S. S. Glaros, H. G. Ahlstrom, and J. T. Larsen Oct. 1977 12 p refs Presented at Ann. Am. Phys. Soc. Meeting, Atlanta, Ga., 7 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-79782; Conf-771136-16) Avail: NTIS HC A02/MF A01

X-ray spectral measurements of laser-produced plasmas were made for photon energies down to 100 eV with a time response of 0.5 nsec. Fast, windowless X-ray diodes were used in conjunction with critical angle reflecting mirrors and thin filters for energy definition for two channels 300 to 600 eV and 800 to 1300 eV. A third channel, using only an X-ray diode and filter, provided spectral information in the 100 to 300 eV region. Results from exploding pusher targets are presented and compared with those of other diagnostic techniques and Lasnex calculations. Future expansion and modifications of the present system are discussed. DOE

N79-10907# California Univ., Livermore. Lawrence Livermore Lab.
CONFIRMATION OF RADIATION PRESSURE EFFECTS IN LASER-PLASMA INTERACTIONS
D. T. Attwood, D. W. Weeney, J. M. Auerbach, and P. H. Y. Lee Oct. 1977 14 p refs Presented at Ann. Am. Physical Soc. Meeting, Atlanta, Ga., 7 Nov. 1977
(Contract W-7405-eng-48)
(UCRL-80132-Rev-1; Conf-771136-1) Avail: NTIS HC A02/MF A01

Interferometric data resolved in 1 millimicron and 15 psec confirms the dominant role of radiation pressure during high intensity laser-plasma interactions. Specifically observed manifestations include electron density profile steepened to 1 millimicron scale length, clearly defined upper and lower density shelves, and small and large scale deformation of transverse isodensity surfaces. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N79-10908 Arizona State Univ., Tempe.
THIRD-ORDER ELASTIC AND PIEZOELECTRIC CONSTANTS OF CUPROUS CHLORIDE Ph.D. Thesis
Kim Gordon Helliwell 1978 129 p
Avail: Univ. Microfilms Order No. 7815233

A complete set of third-order elastic and piezoelectric constants at room temperature for cuprous chloride was obtained from ultrasonic measurements of principal axis elastic wave velocities as a function of hydrostatic pressure or uniaxial stress. The Keating model was used to extract microscopic force parameters from the second- and third-order elastic constants. The scaling of these parameters is discussed, and certain scaling rules which had been previously proposed are seen to be violated by CuCl. The hydrostatic pressure derivatives of the elastic constants of CuCl at 298 K and at 77 K were used to calculate estimates of the thermal Gruneisen parameter for both temperatures. The nonlinear piezoelectric constants are discussed in the context of a simple model for linear piezoelectricity. Dissert. Abstr.

N79-10909 Rochester Univ., N. Y.
EXPERIMENTAL STUDIES ON TWO KONDO LATTICE SYSTEMS: CeAl2 AND Ce SUB 1-x Th SUB x Ph.D. Thesis
Mark Clyde Croft 1978 121 p
Avail: Univ. Microfilms Order No. 7815269

The polycrystalline thermal expansion and magnetostriction of CeAl2 in fields up to 115KOe and temperature below 20 K was investigated as well as the valence instability in the cesium thorium alloy. An appendix generalizing the Weiss molecular field approximation numerically to high fields for ferromagnetic and antiferromagnetic interactions is presented. Another appendix with a general formulation of the Landau theory of a simple critical point in alloy systems is included. Dissert. Abstr.

N79-10910 State Univ. of New York at Buffalo.
STUDY OF A TWO-DIMENSIONAL ELECTRON GAS IN A WEAK MAGNETIC FIELD Ph.D. Thesis
Tadashi Toyoda 1978 63 p
Avail: Univ. Microfilms Order No. 7817086

A many-body theory of a two-dimensional electron gas in a

magnetic field is presented. The field dependence of the Fermi momentum shows a 2-D peculiarity. It consists of the spin-dependent paramagnetic part and the orbital diamagnetic part. The former increases more strongly with r sub s than the latter. The para- and dia-magnetic susceptibilities are found as functions of r sub s. The field-dependent ground state energy is evaluated. Its paramagnetic part decreases steadily with r sub s, while the diamagnetic part shows a maximum. No such a maximum was found for the 3D case in the same approximation which is valid for high density and low magnetic fields. From the susceptibilities, an effective g factor and an effective mass are derived.
Dissert. Abstr.

N79-10911 California Univ., Irvine.
OPTICAL PROPERTIES OF DOPED SEMICONDUCTORS; THE EFFECTS OF MANY BODY INTERACTIONS Ph.D. Thesis
Robert Joseph Sirko 1978 182 p
Avail: Univ. Microfilms Order No. 7815331

The influence of finite electron densities and electron-electron interactions on optical properties of N type doped semiconductors is discussed. Theories of LO phonon induced free carrier absorption and ionized impurity mediated free carrier absorption are extended. The interactions between local phonon modes with electron gas are described. Each of the topics is developed formally, and numerical computations based on the formalism are carried out. The results are compared to earlier theoretical work and experimental data. A description of absorption in the Drude tail includes both the electron-gas phonon mediated processes and the electron gas-ionized impurity processes. Raman scattering studies indicating that there is strong mixing of the local phonon modes and the electron plasma are included. Dissert. Abstr.

N79-10912 Cornell Univ., Ithaca, N. Y.
BOUNDARY FREE ENERGY IN LATTICE SPIN SYSTEMS Ph.D. Thesis
Gunduz Caginap 1978 261 p
Avail: Univ. Microfilms Order No. 7817823

The existence and properties of the boundary free energy function for lattice systems with arbitrary scalar spin variables or two-component vector spins were investigated. A definition of a standard pair of plane walls or boundaries is made by dividing a general d-dimensional lattice domain into two subdomains and severing all interactions between them. The change in total free energy associated with this process provides a standard definition of the boundary free energy for free boundaries. However, associated boundary conditions, also play a role. Banach space techniques are utilized in an analysis of ferromagnetic interactions. Dissert. Abstr.

N79-10913 California Inst. of Tech., Pasadena.
RENORMALIZATION TECHNIQUES IN THE STUDY OF CRITICAL PHENOMENA. 1: LATTICES OF EFFECTIVELY NONINTEGRAL DIMENSIONALITY. 2: A MODEL OF THE MELTING TRANSITION Ph.D. Thesis
Deepak Dhar 1978 157 p
Avail: Univ. Microfilms Order No. 7818199

An explicit construction for a class of lattices with effectively non-integral dimensionality is given and illustrated. The effective dimensionality of some of these lattices is calculated. The attainable values of the dimensionality d are densely distributed in the interval 1 is less than d is less than infinity. The variation of critical exponents with dimensionality is studied for a variety of Hamiltonians. Melting in solids is treated as a layer phenomenon, the onset of melting being characterized by the ability of layers to sip past each other. The variations of the root-mean-square deviation of atoms in one layer as the temperature is increased is studied. The adjacent layers are assumed held fixed and provide an external periodic potential. The couping between atoms within the layer is assumed to be simple harmonic. Dissert. Abstr.

N79-10914 Drexel Univ., Philadelphia, Pa.
VIBRATIONAL SPECTRA OF MIXED MOLECULAR CRYSTALS Ph.D. Thesis
Kent Robert Witters 1978 122 p
Avail: Univ. Microfilms Order No. 7817994

Two chemically mixed molecular crystal systems (CO2/N2O and N2/CO), were studied in the lattice mode region. The Raman spectra of the CO2/N2O mixed crystals show amalgamation limit behavior, indicating that the librations of CO2 and N2O couple well. In the N2/CO mixed crystals, the Raman spectra show a combiation of amalgamation and separated band limit behavior, indicating that the librations of N2 and CO are coupled, but that the coupling is not complete. The spectra of both mixed crystal systems are shown to be consistent with the liberational exciton concept when perturbations in the site energy and excitation exchange interactions are considered. The simultaneous transitions in crystalline CO2 and N2O were studied. Several new transitions were assigned, and previous assignments were verified. Dissert. Abstr.

N79-10915 Cornell Univ., Ithaca, N. Y.
CHIRALITY CONSERVATION IN THE LATTICE GAUGE THEORY Ph.D. Thesis
Michael Edward Peskin 1978 194 p
Avail: Univ. Microfilms Order No. 7817802

The equation for the isospin-singlet current contains an extra term, the operator F sub UV F superscript not present in the other chirality conservation laws; however, this term conventionally has the form of a total divergence and so still allows the definition of a conserved chiral current. When the effects of maintaining gauge invariance are properly taken into account, the structure of this operator is altered by renormalization effects, so that it provides an explicit breaking of the unwanted chiral invariance. The relation between this argument, based on renormalization is traced to a set of more heuristic arguments based on gauge field topology given by 't Hooft. The formal derivation of conservation laws for chiral currents is set out in detail. In the process, a general formalism is developed for deriving continuum field equations from a quantum field theory defined on a lattice, based on renormalization-group methods which are applied to statistical-mechanical lattice systems. Dissert. Abstr.

N79-10916# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INFLUENCE OF IONICITY OF THE BAND STRUCTURE OF III-V SEMICONDUCTORS WITH THE APW-(APPROACHING k)(APPROACHING p) METHOD
A. Ferreira DaSilva (Inst. de Fis. Gleb Wataghin, UNICAMP, Sao Paulo, Brazil), I. C. Dacunha Lima, and N. J. Parada Aug. 1978 17 p refs
(INPE-1343-PE/162) Avail: NTIS HC A02/MF A01

A band structure calculation is performed on GaAs with the augmented plane wave method and approaching k approaching p expansion, taking into account ionicity in addition to covalent bonding. Energy levels at point are also obtained for AlAs and the same behavior for the variation with ionicity is observed. In both cases gaps decrease with increasing ionicity. For GaAs the value E sub g = 1.52 eV is obtained for 10% of ionicity and for AlAs a 20% of ionicity is necessary to produce the direct gap E sub g = 2.50 eV. The absolute value of the matrix elements of the momentum operator varies weakly with ionicity. Valence and lower conduction bands move almost rigidly, decreasing the gap. Author

N79-10917*# National Aeronautics and Space Administration. Pasadena Office, Calif.
A METHOD AND MEANS FOR GROWING RIBBON CRYSTALS WITHOUT SUBJECTING THE CRYSTALS TO THERMAL SHOCK-INDUCED STRAINS Patent Application
Samuel Berkman (RCA Corp., Princeton, N. J.), Harold E. Temple (RCA Corp., Princeton, N. J.), and Kyong-Min Kim, inventors (to NASA) (RCA Corp., Princeton, N. J.) Filed 31 Aug. 1978 12 p
(Contract JPL-954465)
(NASA-Case-NPO-14298-1; US-Patent-Appl-SN-938579) Avail: NTIS HC A02/MF A01 CSCL 20B

A susceptor particularly suited for use in growing crystal ribbons is described which employs edge-defined film-fed growth techniques and is characterized by a die through which a melt is drawn for forming a crystal ribbon. A pair of jets are adjacently related to the die for directing streams of fluid coolant along paths extended to impinge on the susceptor in close proximity with the die, but in non-incident relation with the crystal ribbon being formed. The growth of a crystal is stabilized without

subjecting the resulting crystal to strain-inducing effects of thermal shock. NASA

N79-10918*# National Aeronautics and Space Administration. Pasadena Office, Calif.
AN IMPROVED APPARATUS FOR USE IN THE PRODUCTION OF RIBBON-SHAPED CRYSTALS FROM A SILICON MELT Patent Application
Samuel Berkman (RCA Corp., Princeton, N. J.) and Harold E. Temple, inventors (to NASA) (RCA Corp., Princeton, N. J.) Filed 31 Aug. 1978 12 p
(Contract JPL-954465)
(NASA-Case-NPO-14297-1; US-Patent-Appl-SN-938299) Avail: NTIS HC A02/MF A01 CSCL 20B

An apparatus employed in the production of ribbon-shaped crystals is characterized by an R-F coil, a crucible for confining a silicon melt, and a susceptor for supporting the crucible and facilitating an electrical coupling of the coil with the melt. The susceptor comprises a pair of susceptor halves of a thickness less than two skin depths, each being the mirror image of the other, disposed in mutually opposed electrically insulated relation, while the crucible comprises a quartz body including side plates and end plates supported by the graphite susceptor whereby the R-F coil is electrically coupled with the melt. A higher average temperature is attained for the melt than that attained for the susceptor walls so that thermal gradients are easier to control and the input energy to the system is conserved. NASA

N79-10919*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MOESSBAUER STUDY IN THIN FILMS OF FeSi2 AND FeSe SYSTEMS
W. J. Escue, Kamma Aggarwal (Indian Inst. of Technology), and R. G. Mendiratta (Indian Inst. of Technology) Sep. 1978 13 p refs
(NASA-TM-78205) Avail: NTIS HC A02/MF A01 CSCL 20L

Thin films of FeSi2 and FeSe were studied using Moessbauer spectroscopy information regarding dangling bond configuration and nature of crystal structure in thin films was derived. A significant influence of crystalline aluminum substrate on film structure was observed. J.M.S.

N79-10920# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ENHANCED HETEROEPITAXY Semiannual Technical Summary Report, 1 Jul. - 31 Dec. 1977
Alan L. McWhorter 31 Dec. 1977 13 p refs
(Contract F19628-78-C-0002; ARPA Order 3336)
(AD-A056917; ESD-TR-77-358) Avail: NTIS HC A02/MF A01 CSCL 20/12

Oriented crystal growth on an amorphous substrate has been achieved using an artificially created submicrometer-dimension surface-relief grating. Crystallites of KCl grown from a water solution onto a 320 nm spatial-period square-wave grating in Si O2 nucleated preferentially at vertical steps and grew with 100 directions parallel to the grating axis. 320-nm spatial-period square-wave gratings fabricated on amorphous Si O2 substrates were used to produce uniform alignment of the director in nematic and smectic liquid-crystal layers. This demonstrates that molecular alignment can be achieved using surface structures fabricated by a planar process. A novel method of producing twisted-nematic liquid-crystal displays using surface gratings is described. Author (GRA)

N79-10921# Maryland Univ., College Park. Dept. of Physics and Astronomy.
RECENT PROGRESS IN SURFACE ANALYSIS
Robert L. Park Jun. 1978 27 p refs
(Contract N00014-75-C-0292; N00014-77-C-0485)
(AD-A056764) Avail: NTIS HC A03/MF A01 CSCL 20/2

The most basic requirements in surface analysis are to identify the chemical constituents and to determine their structural arrangement. It may be possible to extract structural information using extended fine structure techniques. Fine structure variations have been observed to extend hundreds of electron volts above appearance potential thresholds. This structure is analogous to extended X-ray absorption fine structure (EXAFS), and can be interpreted in terms of interatomic distances in the surface region. The recent development of extended appearance potential fine structure (EAPFS) analysis is reviewed. The technique is of potential benefit in the resolution of LEED analysis problems on single crystal surfaces, as well as in the study of less ideal surfaces. The present limitations of the technique are stressed and analytical and experimental approaches to minimizing these limitations are discussed. GRA

N79-10922# SRI International Corp., Menlo Park, Calif.
ENCAPSULATION AND ANNEALING OF SULFUR AND SELENIUM IMPLANTED GALLIUM ARSENIDE Final Report, 1 May 1975 - 10 Sep. 1977
T. J. Magee, J. F. Gibbons, A. Lidow, J. Peng, and E. Ammar Wright-Patterson AFB, Ohio AFAL 24 Mar. 1978 97 p refs
(Contract F33615-75-C-1084; AF Proj. 7885)
(AD-A056862; AFAL-TR-77-239) Avail: NTIS HC A05/MF A01 CSCL 20/12

This report describes progress on a program to investigate encapsulation .films used as annealing caps on ion implanted GaAs samples and to develop alternative procedures and techniques for improving the efficiency of n-type ion implants. The major high impact technological achievement of this research program has been the development and perfection of a chemically inert double layered encapsulation system which improves the electrical performance of ion implanted layers as well as allowing reliable annealing at temperatures up to 1100 C. Author (GRA)

N79-10923# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology and Devices Lab.
ESR CENTERS AND CHARGE DEFECTS NEAR THE SILICON/SILICON DIOXIDE INTERFACE
Edward H. Poindexter, Edward H. Ahlstrom, and Philip J. Caplan Apr. 1978 10 p refs Presented at Intern. Topical Conf. on the Phys. of SiO2 and its Interfaces, Yorktown Heights, N. Y., 22-24 Mar. 1978
(DA Proj. 1L1-61102-AH-47)
(AD-A056582; DELET-TR-78-9) Avail: NTIS HC A02/MF A01 CSCL 20/12

The Nishi-B esr center has been examined as a function of thermal oxidation and annealing conditions in single-crystal silicon wafers. It was observed that B concentration was not correlated with fixed surface-state charge density Q, despite some similarities in their behavior. In freshly oxidized wafers, B typically ranges up to 200 per nm sq, and Q up to 50 per nm sq. The concentration of B is highly dependent on cooling rates; concentration does not depend on oxide thickness and B may be observed even in native oxides. The g-value of the orientation-averaged B signal (2.0064) favors its assignment to trivalent Si in a silicon environment, as in crushed silicon (2.0055), rather than to the well-studied E centers (2.0008) found in various forms of damaged silicon dioxide. In our thermal oxides, E centers were unobservable, and thus cannot be the main source of Q, despite their nominal positive charge. Preliminary evidence shows a correlation of B with initial, unannealed fast interface states N, supporting the idea that trivalent Si is the origin of these states. Author (GRA)

N79-10924# Philips Labs., Briarcliff Manor, New York.
GROWTH OF HIGH-QUALITY CESIUM DIDEUTERIUM ARSENATE CRYSTALS Final Report, 14 Apr. 1975 - 15 Aug. 1976
G. M. Loiacono, W. N. Osborne, and M. Delfino Wright-Patterson AFB, Ohio AFAL Dec. 1976 73 p refs
(Contract F33615-75-C-1202)
(AD-A057131; AFAL-TR-76-215) Avail: NTIS HC A04/MF A01 CSCL 20/2

The growth of cesium dideuterium arsenate (CsD2AsO4) crystals from aqueous and mixed solvent systems was studied, with emphasis on the problems of tapering and flawing. Fluid flow, seed orientation, deuteration, impurities, pH and saturation temperature had negligible effects on taper. An empirical process for growing taper-free CsD2AsO4 was developed. This process consisted of initial capping of a seed plate in D2O solvent followed by growth of the capped seed in a D2O/glycol solvent. The optical absorption, 90 degree phase-matching temperature, and thermal stability of CsD2AsO4 as a function of deuteration were determined. A high-temperature (409 K), destructive, phase transition was discovered in CsD2AsO4. As a

result, a compromise between optical absorption and the 90 degree phase-matching temperature had to be made. Six crystals were characterized and delivered. Author (GRA)

N79-10925# Los Alamos Scientific Lab., N. Mex.
DISPLACEMENTS AND STRESSES ABOUT AN ARBITRARILY LOADED SPHEROIDAL INCLUSION
Robert Nashner and Nick Warren Mar. 1978 38 p refs
(Contracts EY-76-S-03-0034; W-7405-eng-36)
(LA-7035-MS) Avail: NTIS HC A03/MF A01

The calculation of theoretical elastic moduli of porous materials is presented. General and unrestricted equations for elastic moduli are presented. The theoretical expressions are written in terms of pore strains and porosities and are summarized. The remaining sections consist of summary descriptions of the computational methods developed for evaluating pore strains and elastic moduli. All of the expressions presented are based on the theoretical results of Edwards for stress concentrations and displacement fields around a single spheroidal inclusion in an infinite medium with an applied arbitrary external load. The solutions of Edwards are discussed. Outlines and examples of certain computer programs using these solutions are given. DOE

N79-10926# Brookhaven National Lab., Upton, N. Y.
SOME NON-LINEAR PHYSICS IN CRYSTALLOGRAPHIC STRUCTURES
S. Aubry Oct. 1977 23 p refs Presented at Intern. Conf. on Stochastic Behavior and Quantum Hamiltonian Systems, Tremezzo, Italy, 20 Jun. 1977
(Contract EY-76-C-02-0016)
(BNL-23419; Conf-770692) Avail: NTIS HC A02/MF A01

Studies on simple but strongly nonlinear crystallographic models that make use of some methods in stochasticity are summarized. Two one-dimensional models are described; one is examined to understand some aspects of the nonlinear dynamics in crystals when close to the transition temperature, the other is for commensurability and incommensurability problems. Periodic orbits and the dynamics of one-dimensional coupled double-well chain are considered, along with lattice locking and stochasticity. DOE

N79-10927# Los Alamos Scientific Lab., N. Mex.
CATALYSIS STUDIES
T. N. Taylor and W. P. Ellis Nov. 1977 40 p refs
(Contract W-7405-eng-36)
(LA-7016-MS) Avail: NTIS HC A03/MF A01

To further understand the surface crystallography of a possible catalyst compound, LEED-Auger measurements were made on UO2 (approximately 100) vicinal surfaces. These (approximately 100) vicinal surfaces were shown to decompose irreversibly into lower index facets, including prominent (100) facets, at temperatures below those needed for creation of lowest index faceting on (approximately 111) vicinal surfaces. LEED examination of fully faceted surfaces from both types of UO2 vicinal cuts did not show evidence of cyclopropane or propene chemisorption. Extensive LEED-Auger measurements were made in CoO in vacuo and in the presence of light hydrocarbons and alcohols plus H2O, NO, and NH3. No chemisorptive behavior was observed except with H2O in the presence of the electron beam. Although only examined briefly, the Cr2O3 was remarkable for the sharp LEED features obtained prior to any surface treatment in the vacuum system. DOE

N79-10928# Illinois Univ., Urbana.
THERMALLY ACTIVATED DISLOCATION MOTION INCLUDING INERTIAL EFFECTS IN SOLID, SOLUTIONS Ph.D. Thesis
Randall Duane Isaac 1977 221 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1182) Avail: NTIS HC A10/MF A01

Dislocation motion through an array of obstacles is considered in terms of the potential energy of the dislocation as it moves through the array. The obstacles form a series of potential wells and barriers which can trap the dislocations. The effect of thermal fluctuations and of a viscous drag on the motion of the dislocation is investigated by analogy with Brownian motion in a field of force. The rate of escape of a trapped dislocation is found to depend on the damping coefficient only for a large viscous drag. The probability that a dislocation will be trapped by a well or barrier is found to depend on the damping coefficient for a small viscous drag. This inertial effect determines how far a dislocation will travel after breaking away from an obstacle. DOE

N79-10929# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
ELECTRICAL AND ELECTRON MICROSCOPY OBSERVATIONS ON DEFECTS IN ION IMPLANTED SILICON M.S. Thesis
H. Ling 26 Feb. 1978 28 p refs
(Contract W-7405-eng-48)
(LBL-7386) Avail: NTIS HC A03/MF A01

Silicon single crystals were implanted with 100 keV phosphorous ions to a dose of 2 x 10 to the 16th power ions/sq cm at both room-temperature and 600 C. They were isochronally annealed at temperatures ranging from 400 C to 900 C. Sheet resistivity measurements of the specimens were taken after each anneal, together with corresponding transmission electron micrographs. The observations show that when a completely amorphous layer is produced by ion implantation at room-temperature, epitaxial recrystallization onto the single crystal substrate during annealing at 600 C leaves a dislocated surface containing secondary defects. There appears to be a significant difference in the number of defects per implanted ion between room-temperature and 600 C implants, when annealing to 800 C and 900 C. Sheet-resistivity measurement showed that, above a critical dose, room temperature implantation followed by a 600 C post anneal is substantially more effective for achieving electrical activity of the phosphorous than is implantation at 600 C. But 600 C implantation followed by 800 C and 900 C post annealed is more effective than room-temperature implantation. DOE

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N79-10930 Johns Hopkins Univ., Baltimore, Md.
FIELD-THEORETIC TREATMENT OF BOUND-STATES Ph.D. Thesis
Alan Paul Schaum 1978 130 p
Avail: Univ. Microfilms Order No. 7817968

The Bethe-Salpeter equation for two-fermion states is reduced to Hamiltonian form involving at most two coupled structure functions. For the case of arbitrary, unequal constituent masses, linear constraints are derived systematically from charge-conjugation invariance and for time-independent interactions. The latter are generalized to pairless instantaneous interactions, with consequent additional constraints. The resultant equations represent the maximum possible reduction of the Bethe-Salpeter equation. A class of interactions is examined, to include electromagnetism in a general gauge. A Hermitization scheme is demonstrated, with resultant effective Hamiltonians that are both linear in the potential and simply dependent on powers of momentum and on the relativistic free-particle energies. Hyperfine effects are examined for the Coulomb interaction, and an example spectrum of masses is generated from a simple-harmonic-oscillator potential, and is compared with charmonium levels.
Dissert. Abstr.

N79-10931*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THREE ONE-DIMENSIONAL STRUCTURAL HEATING PROGRAMS
Lawrence D. Wing Sep. 1978 143 p refs Submitted for publication
(NASA-TM-79587) Avail: NTIS HC A07/MF A01 CSCL 20M

Two computer programs for calculating profiles in a ten-

element structure consisting of up to ten materials are presented, along with a third program for calculating the mean temperature for a payload container placed in an orbiting vehicle cargo bay. The three programs are related by the sharing of a common analytical technique; the energy balance is based upon one-dimensional heat transfer. The first program, NQLDW112, assumes a non-ablating surface. NQLDW117 is very similar but allows the outermost element to ablate. NQLDW040 calculates an average temperature profile through an idealized model of the real payload cannister and contents in the cargo bay of an orbiting vehicle. Author

N79-10932# Naval Postgraduate School, Monterey, Calif.
AN APPARATUS TO MEASURE DROPWISE CONDENSATION HEAT TRANSFER COEFFICIENTS OF STEAM M.S. Thesis
Larry Ralph Sharp Mar. 1978 89 p refs
(AD-A056395) Avail: NTIS HC A05/MF A01 CSCL 20/13

An experimental apparatus was designed and constructed for the purpose of determining dropwise condensation heat transfer coefficients on condensing surfaces of different thickness. The equipment included a completely self contained condensing chamber which enclosed both the boiler and condensing surface. Variable temperature cooling water was utilized to control the heat flux. An intrinsic thermocouple was used in lieu of the thin film resistance thermometer. Experimental data was taken for a 0.51 mm thick stainless steel condensing surface. Results indicated the existence of a condensing curve similar in shape to the characteristic boiling curve represented by heat flux versus T sub vapor - T sub wall. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N79-10933# Decisions and Designs, Inc., McLean, Va.
RESEARCH ON THE TECHNOLOGY OF INFERENCE AND DECISION Final Report, 1 Oct. 1976 - 30 Sep. 1977
Ward Edwards, Richard John, and William Stillwell Nov. 1977 45 p refs
(Contract N00014-76-C-0074; ARPA Order 3052)
(AD-A056921) Avail: NTIS HC A03/MF A01 CSCL 05/1

This report summarizes twelve months of research on the technology of inference and decision. Theoretical research and experimental work on three major topics; elicitation of subjective probabilities, multi-attribute utility theory, and the application of decision technology, is discussed. Experimental work showed that simple averaging of individual's probability judgments to form a group judgment did not differ significantly from behavioral interaction in final quality of the judgments as evaluated by a quadratic scoring rule. Other experimental work indicated that elicitation techniques were of significant importance to the quality of judgments. Response scales were found to affect both the magnitude and veridicality of probabilistic judgment. In the assessment of subjective probability distributions elicitation technique was found to interact with the type of distribution used to generate the data in that biases introduced in subjective probability distributions varied as a function of the uncertain quantity being assessed. GRA

N79-10934# National Technical Information Service, Springfield, Va.
MATHEMATICAL MODELS OF MANPOWER AND PERSONNEL MANAGEMENT, VOLUME 2 Progress Report, 1974 - Jun. 1978
Mary E. Young Jul. 1978 276 p Supersedes NTIS/PS-77/0623; NTIS/PS-76/0564; NTIS/PS-75/499
(NTIS/PS-78/0668/0; NTIS/PS-77/0623; NTIS/PS-76/0564; NTIS/PS-75/499) Avail: NTIS HC $28.00/MF $28.00 CSCL 05I

Models of manpower allocation, systems, and requirements, as well as specific task systems, forecasting, and evaluation are included in the cited reports. Both military and civilian requirements are covered. (This updated bibliography contains 270 abstracts, 68 of which are new entries to the previous edition.) GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N79-10935* National Aeronautics and Space Administration, Washington, D. C.
THE NASA SCIENTIFIC AND TECHNICAL INFORMATION SYSTEM: ITS SCOPE AND COVERAGE
Sep. 1978 287 p ref
(NASA-TM-79903) Avail: NASA Scientific and Technical Information Facility P. O. Box 8757 B.W.I. Airport, Md. 21240 CSCL 05B

Subjects of scientific and technical documents considered for inclusion in NASA's information bank are broadly summarized under the various categories used in Scientific and Technical Aerospace Reports and International Aerospace Abstracts. A general definition of each category is followed by a list of the aspects of each subject which are of exhaustive, selective, or negative interest because of their relevance to aerospace science and technology and to other NASA projects. A.R.H.

N79-10936# Applied Management Sciences, Inc., Silver Spring, Md.
A STUDY OF LIBRARY COOPERATIVES, NETWORKS AND DEMONSTRATION PROJECTS, VOLUME 1: FINDINGS AND RECOMMENDATIONS Final Report
Ruth Patrick, Joseph Casey, Carol Novalis, and Arthur Kirschenbaum 31 Mar. 1978 477 p refs 2 Vol.
(Contract OE-300-76-0464)
(PB-282526/3; OE/OHD-76/24-1-Vol-1) Avail: NTIS HC A21/MF A01 CSCL 05B

The impacts of the HEA IIb and the LSCA III programs are assessed. Data was obtained at the Federal state and project level by means of mail questionnaire, telephone interviews and on site visits. Program effectiveness was adjudged through services, finances, personnel evaluation, and dissemination of program information. Inquiry was also made relevant to policy and operation. The final results propose restructuring existing federal library legislation to conform to a three stage model, consisting of: innovation knowledge building, testing/capacity building, and program operation. GRA

N79-10937# Applied Management Sciences, Inc., Silver Spring, Md.
A STUDY OF LIBRARY COOPERATIVES, NETWORKS AND DEMONSTRATION PROJECTS, VOLUME 2. CASE STUDY REPORTS: TWELVE PROJECTS SUPPORTED BY THE HEA 2-B LIBRARY RESEARCH AND DEMONSTRATION PROGRAM AND LSCA 3 MULTITYPE LIBRARY COOPERATION AND NETWORKING IN TEN STATES Final Report
Joseph Casey, Carol Novalis, and Ruth Patrick 31 Mar. 1978 442 p 2 Vol.
(Contract OE-300-76-0464)
(PB-282527/1; OE/OHD-76/24-2-Vol-2) Avail: NTIS HC A19/MF A01 CSCL 05B

Results are presented of Applied Management Sciences Study of Library Cooperatives, Networks, and Demonstration Projects. Case studies appropriate to the two Federal programs falling within the scope of the study are described. These are the Library

Research and Demonstration Component of Title 2-B of the Higher Education Act, and Title 3 of the Library Services and Construction Actinterlibrary cooperation and networking. Part one presents 12 case studies of HEA II-B Library Research and Demonstration projects, and Part two presents case studies of the operation and impact of LSCA III in 10 states. The case studies provide important insights into operations of the two Programs and have implications for future directions in networking and library research and demonstration at all levels. GRA

N79-10938# Office of Management and Budget, Washington, D. C. President's Reorganization Project.
FEDERAL DATA PROCESSING REORGANIZATION STUDY: SMALL USERS TEAM REPORT Final Report
Herbert Pier, William Kirby, John Yankcviak, and Donald Cohen 1 Jul. 1978 95 p refs
(PB-284134/4) Avail: NTIS HC A05/MF A01 CSCL 05B

The Federal Data Processing Reorganization Project was initiated to study and recommend improvements in the way in which the Federal Government acquires, manages and uses information technology. The Small Users team was tasked to study the management of information technology by agencies whose expenditures for data processing resources was less than $10 million annually. The current management of information technology by small user agencies, documents the extent and causes of real or perceived problems, identifies, describes, and analyzes viable options as solutions to those problems, and makes recommendations for improvement based on the options is described. GRA

N79-10939# Office of Management and Budget, Washington, D. C. President's Reorganization Project.
FEDERAL DATA PROCESSING REORGANIZATION STUDY: INFORMATION TECHNOLOGY; CHALLENGES FOR TOP PROGRAM MANAGEMENT IN THE GENERAL GOVERNMENT AGENCIES Final Report
John Stucker, Todd Balfanz, Felix Rausch, and Robert Hammond Jun. 1978 67 p refs
(PB-284135/1) Avail: NTIS HC A04/MF A01 CSCL 05B

The Federal Data Processing Reorganization Project was initiated to study and recommend improvements in the way in which the Federal Government acquires, manages, and uses information technology. The management of information technology by various agencies, documents the extent and causes of real or perceived problems with that management, identifies, describes, and analyzes viable options as possible solutions to those problems, and makes recommendations for improvement based on the options. GRA

N79-10940# Engineering Index, Inc., N.Y.
ALTERNATIVES FOR ACCESSING ENGINEERING NUMERICAL DATA, PHASE 1 Final Report
John H. Veyette, Jr., Robert Bezilla, and Y. S. Towlowkian Mar. 1978 170 p refs Prepared in cooperation with Benson and Benson, Inc., Princeton, N. J. and Purdue Univ., Lafayette, Ind.
(Grant NSF DS-176-16654)
(PB-282609/7; EIX-78/1) Avail: NTIS HC A08/MF A01 CSCL 05B

The data gathering procedures described ranged from utilization of primitive ad hoc methods to a mention of use of an in-house evaluated data system. For the most part, however, the engineer's information sources and procedures appeared to be confined largely to use of handbooks, departmental data, and personal contact with co-workers, in-house specialists, sub-contractors and vendors. The engineers surveyed seemed receptive to recognizing shortcomings in their current pragmatic practices. It was concluded that a proposal to make evaluated data available to the engineering community in on-line interactive mode will meet a set of true needs. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N79-10941*# Florida Univ., Gainesville. Agricultural Market Research Center.
COMMERCIAL FISHING PORT DEVELOPMENT IN NORTH FLORIDA
Kary Mathis, James C. Cato, Robert L. Degner, Paul D. Landrum, and Fred J. Prochaska Sep. 1978 241 p refs Sponsored in part by the Gulf and South Atlantic Fisheries Development Foundation, Inc.
(Grant NsG-7236)
(NASA-CR-157783; Rept-78-6) Avail: NTIS HC A11/MF A01 CSCL 05C

Commercial fishing activity and facility needs were reviewed for a 23 county area of north Florida. Seven counties were identified as having major fishing activity, nine had an intermediate level of fishing, and seven were minor fishing areas. The seven major counties: Escambia, Bay, Gulf, Franklin, Wakulla, Nassau and Duval are emphasized. Population and economic activity are included. J.M.S.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N79-10942*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PLANNING FOR AIRPORT ACCESS: AN ANALYSIS OF THE SAN FRANCISCO BAY AREA
Jarir S. Dajani, ed. (Stanford Univ., Calif.), James V. Jucker, ed., and J. Lloyd Jones (Stanford Univ.) May 1978 300 p refs Stanford-NASA-ASEE Summer Faculty Fellowship Program on Eng. System Design held at Moffett Field, Calif., 1977
(Grant NGR-05-020-409)
(NASA-CP-2044; A-7347) Avail: NTIS HC A13/MF A01 CSCL 13F

A description of the airport area, its current transportation capabilities, and recommendations for future access planning are presented. For individual titles, see N79-10943 through N79-10948.

N79-10943*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PLANNING FOR AIRPORT ACCESS: AN ANALYSIS OF THE SAN FRANCISCO BAY AREA. INTRODUCTION AND CONCLUSIONS
In its Planning for Airport Access May 1978 p 1-14 (For primary document see N79-10942 01-85)
Avail: NTIS HC A13/MF A01 CSCL 13F

The problems of airport access are examined and recommendations are made based on current transportation availability, public costs, and future transportation demand. Major conclusions presented include: (1) access must be considered in the contex of the overall urban transportation system, (2) expensive and inflexible travel modes designed primarily for airport access are not justifiable, (3) VTOL and STOL are presently too expensive for large-scale commercial use, and (4) the automobile will continue to be the predominant access mode in the future. S.B.S.

N79-10944*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PLANNING FOR AIRPORT ACCESS: AN ANALYSIS OF THE SAN FRANCISCO BAY AREA. THE SETTING
In its Planning for Airport Access May 1978 p 15-50 refs
(For primary document see N79-10942 01-85)
Avail: NTIS HC A13/MF A01 CSCL 13F

The regional setting for the three San Franscisco Bay area airports is described. The general role of the airports in the national air transportation system, the demand for air transportation, and the relationship of airport location to the demand for air transportation are examined. The problem of airport access is also considered. Various access modes, their destination, frequency, and cost are presented. S.B.S.

N79-10945*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COMPONENTS OF THE AIRPORT ACCESS SYSTEM
In its Planning for Airport Access May 1978 p 51-126 refs
(For primary document see N79-10942 01-85)
Avail: NTIS HC A13/MF A01 CSCL 13F

The organizations and agencies which make up or influence the airport access system are examined. These include the airport, the airline industry, the public and private transit agencies which provide ground access to the airport, and the regulatory agencies which affect all of these organizations and their actions. Each component, with the exception of the regulatory agencies is described in terms of its legal status, its sources of funds, and the nature of its relationship with the other components. Conclusions regarding the system components' effects on airport access and recommendations for changes which appear practical are presented. S.B.S.

N79-10946*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PLANNING FOR AIRPORT ACCESS: AN ANALYSIS OF THE SAN FRANCISCO BAY AREA. EXISTING STUDIES
In its Planning for Airport Access May 1978 p 127-154 refs
(For primary document see N79-10942 01-85)
Avail: NTIS HC A13/MF A01 CSCL 13F

The transportation systems studies completed, which have a bearing on the area's airport access system, are surveyed. A brief description of some of the selected studies, a framework for their evaluation, and an assessment of their proposals are provided. Areas of concentration presented include: (1) San Francisco International Airport, (2) Metropolitan Oakland International Airport, (3) San Jose Municipal Airport, and (4) Regional and Local transportation systems. S.E.S.

N79-10947*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PLANNING FOR AIRPORT ACCESS: AN ANALYSIS OF THE SAN FRANCISCO BAY AREA. TECHNOLOGICAL OPTIONS
In its Planning for Airport Access May 1978 p 115-188 refs
(For primary document see N79-10942 01-85)
Avail: NTIS HC A13/MF A01 CSCL 13F

Current transportation technology and expected technological trends are reviewed. These technologies are assessed within the framework of the airport access system in the San Francisco Bay area. Four types of technological options are considered: (1) automotive systems, (2) commuter air systems, (3) automated guideways, and (4) water systems. S.E.S.

N79-10948*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PLANNING FOR AIRPORT ACCESS: AN ANALYSIS OF THE SAN FRANCISCO BAY AREA. THREE SUBSYSTEM DESIGNS **c15**
In its Planning for Airport Access May 1978 p 189-250 refs
(For primary document see N79-10942 01-85)
Avail: NTIS HC A13/MF A01 CSCL 22B

The outcomes of three analytical studies are presented. Areas of concentration presented include: (1) Zonal Airport Transit System designed to address the problem of airport access options, (2) the issues and problems of airport parking and circulation, and (3) the problems of effectively providing airport access information. S.E.S.

N79-10949# Hawaii Univ., Honolulu. Water Resources Research Center.
ROTATING DISC SEWAGE TREATMENT SYSTEMS FOR SUBURBAN DEVELOPMENT AND HIGH-DENSITY RESORTS OF HAWAII
Gary T. Griffith, Reginald H. F. Young, and Michael J. Chun Jan. 1978 20 p refs
(Contract DI-14-34-0001-7025)
(PB-281806/0; TMR-56; W78-07393; OWRT-A-068-HI (1))
Avail: NTIS HC A02/MF A01 CSCL 13B

Experience with extended aeration plants in high density resort and suburban developments in Hawaii was generally unsatisfactory due to (1) inadequate system management resulting from insufficient manpower resources, and (2) high energy input required for aeration. A large scale pilot rotating disc unit was developed and field tested as a practical alternative to such extended aeration systems. Information on the basic theory of operation, pilot plant sizing and configuration, pilot system operation and data-gathering techniques, and hydraulic and organic loading rates is provided. GRA

N79-10950# Purdue Univ., Lafayette, Ind. Water Resources Research Center.
THE EFFECTS OF TEMPERATURE CONTROL ON BIOLOGICAL WASTEWATER TREATMENT PROCESSES Technical Report, 1 Jul. 1975 - 30 Jun. 1978
C. E. Collins, C. P. L. Grady, Jr., and F. P. Incropera Mar. 1978 161 p refs Sponsored by Dept. of Interior
(PB-281567/1; TR-98; W78-07001; OWRT-A-042-IND(2))
Avail: NTIS HC A08/MF A01 CSCL 13B

The feasibility of using waste heat to optimize the performance of a biological wastewater treatment facility through temperature control is discussed. The effect of temperature on biological wastewater treatment was modelled by considering its influence on several important processes. The specific influence of temperature on the bacterial kinetic parameters, the oxygen transfer process, and the biomass settling was included in the model. The results of a computer simulation show that an optimal temperature for operation of a secondary wastewater treatment facility is approximately 25 C. GRA

N79-10951# National Technical Information Service, Springfield, Va.
TECHNOLOGY ASSESSMENT, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Jul. 1975 - Jul. 1977
Carolyn Shonyo Aug. 1978 244 p
(NTIS/PS-78/0830/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 05A

The bibliography cites references concerning the assessment of technology in a wide variety of fields from social to the physical sciences. Theoretical and applied studies are covered. This updated bibliography contains 237 abstracts, none of which are new entries to the previous edition. GRA

N79-10952# National Technical Information Service, Springfield, Va.
TECHNOLOGY ASSESSMENT, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Aug. 1977 - Jun. 1978
Carolyn Shonyo Aug. 1978 208 p Supersedes NTIS/PS-77/0624; NTIS/PS-76/0483; NTIS/PS-75/494
(NTIS/PS-78/0831/4; NTIS/PS-77/0624; NTIS/PS-76/0483; NTIS/PS-75/494) Avail: NTIS HC $28.00/MF $28.00 CSCL 05A

The bibliography cites references concerning the assessment of technology in a wide variety of fields from social to the physical sciences. The majority of the references are in the applied physical sciences, including energy. Theoretical and applied studies are covered. GRA

N79-10953# Stanford Univ., Calif. Dept. of Civil Engineering.
SOLUBLE ORGANIC NITROGEN CHARACTERISTICS AND REMOVAL Final Report, 1 Sep. 1974 - 1 May 1977
Stephen J. Randtke, Gene F. Parkin, John V. Keller, James O. Leckie, and Perry L. McCarty Mar. 1978 274 p refs
(Grant EPA-R-804001)
(PB-281727/8; EPA-600/2-78-030) Avail: NTIS

HC A12/MF A01 CSCL 13B

Sources, concentrations, characteristics and methods for removal of Soluble Organic Nitrogen (SON) in wastewater are discussed. Removal by various physical chemical and biological processes are described and molecular weight distribution is characterized. A significant portion of the SON in secondary effluent is produced biologically during treatment. Chemical coagulation, ion exchange and activated carbon were used singly and in combination to characterize different fractions of the SON and the Soluble Chemical Oxygen Demand (SCOD). GRA

N79-10954# Municipal Environmental Research Lab., Cincinnati, Ohio.

PARALLEL EVALUATION OF CONSTANT AND DIURNAL FLOW TREATMENT SYSTEMS

John H. Bender Mar. 1978 72 p refs

(PB-281401/0; EPA-600/J-78-034) Avail: NTIS HC A04/MF A01 CSCL 13B

Pilot plant studies were performed to evaluate the effects of imposed diurnal flow pattern on a conventional activated sludge treatment plant. These results were compared against data generated on a similar system treating a constant flow. Effects on primary clarifier and final clarifier performance as well as soluble or organic removals were evaluated. Other effects on general plant stability were noted. GRA

N79-10955# Culp/Wesner/Culp, El Dorado Hills, Calif.

A COMPARISON OF OXIDATION DITCH PLANTS TO COMPETING PROCESSES FOR SECONDARY AND ADVANCED TREATMENT OF MUNICIPAL WASTES

William F. Ettlich Mar. 1978 192 p refs

(Contract EPA-68-03-2186)

(PB-281380/6; EPA-600/2-78-051) Avail: NTIS HC A09/MF A01 CSCL 13B

Characteristics of oxidation ditch plants are examined with emphasis on design, plant equipment, operational problems and maintenance requirements, construction costs, and nitrification and nitrogen removal applications. These aspects of plant operation are compared with those for competing biological treatment processes as well as physical chemical processes. GRA

N79-10956# Virginia Highway and Transportation Research Council, Charlottesville.

TRAFFIC FLOW EVALUATION OF PAVEMENT INSET LIGHTS FOR USE DURING FOG Final Report

Frank D. Shepard Dec. 1977 31 p refs Sponsored by DoT and Virginia Dept. of Highways and Transportation.

(PB-281163/6; VHTRC-78-R25) Avail: NTIS HC A03/MF A01 CSCL 13B

The characteristics of the traffic flow within the system of pavement inset lights were investigated on Afton Mountain during fog through the collection and analysis of traffic flow data before and after the lights were installed. The traffic flow parameters evaluated were vehicle speeds, headways, queues, and lateral placement. A before and after accident analysis also was made. Overall, the lighting system led to higher nighttime speeds, an increase in speed differentials for various cases during both daytime and nighttime, and to a decrease in nighttime headways and queuing. GRA

N79-10957# Office of Technology Assessment, Washington, D. C.

APPLICATIONS OF R/D IN THE CIVIL SECTOR: THE OPPORTUNITY PROVIDED BY THE FEDERAL GRANT AND COOPERATIVE AGREEMENT ACT OF 1977

Jun. 1978 47 p refs

(PB-283035/4; OTA-R-65) Avail: NTIS HC A03/MF A01 CSCL 05A

The framework established by the act has important implications for Federally funded R&D and for the Federal impact on innovation involving private industry, the universities and nonprofit organizations, and State and local governments. Discussed in this volume are assistance and procurement relationships, the relationship of Federal and non-Federal R&D agencies and agreements, and related implications for Congressional oversight. GRA

N79-10958# DeLeuw, Cather and Co., Chicago, Ill.

AGT GUIDEWAY AND STATION TECHNOLOGY. VOLUME 2: WEATHER PROTECTION REVIEW Final Report

R. D. Stevens, T. J. Nicarico, and T. J. McGean Mar. 1978 146 p refs Prepared in Cooperation with ABAM Engineers, Tacoma, Wash.

(Contract DOT-UT-70066)

(PB-281632/0; UMTA-IT-06-0152-79-1-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 13F

The AGT Guideway and Station Technology Project are reported. The project developed guideway, station, and weather protection concepts which will reduce the cost and implementation time associated with AGT systems. The review of the weather protection area is addressed. A review is presented of the experiences of AGT systems under severe winter weather conditions as well as a review of the experiences of non-AGT transportation modes (railroads, airports, and highways). Three areas of winter weather impact on AGT systems are presented: traction, power collection, and switching. GRA

N79-10959# Michigan Univ., Ann Arbor. Highway Safety Research Inst.

DEVELOPMENT OF TECHNIQUES FOR INVESTIGATING ACCIDENT CAUSATION Final Report, 1 Jul. 1976 - 31 Dec. 1977

Leonard Johnson and Leonard Segel Jan. 1978 86 p refs Sponsored in part by Motor Vehicle Manufacturers Assoc. of the U.S., Inc.

(PB-281707/0; UM-HSRI-78-4) Avail: NTIS HC A05/MF A01 CSCL 13F

The feasibility of estimating steering response characteristics for both individual vehicles and entire vehicle populations as they are affected by in-use tire and loading conditions was investigated. The distribution of these response characteristics was calculated for an at-risk vehicle population and an accident-involved vehicle population. The role of vehicle handling in accident causation is evaluated in terms of these particular characteristics. GRA

N79-10960# National Highway Traffic Safety Administration, Washington, D. C. Technical Services Div.

CRASHWORTHINESS OF MOTOR VEHICLES. A SUBJECT BIBLIOGRAPHY FROM HIGHWAY SAFETY LITERATURE

Lois Flynn Mar. 1978 211 p

(PB-281716/1; DOT-HS-803; SB-27) Avail: NTIS HC A10/MF A01 CSCL 13F

The bibliography represents literature acquired since the establishment of the National Highway Traffic Safety Administration (NHTSA) as related to the crashworthiness of motor vehicles. It is comprised of NHTSA contract reports, reports of other organizations concerned with highway safety, and articles from periodicals in related fields. Citations follow the format used in the monthly abstract journal Highway Safety Literature and are indexed by a kew-word-out-of-context (KWOC) listing, author, corporate author, contract number, and report number. GRA

N79-10961# ENSCO, Inc., Alexandria, Va. Engineering Test and Analysis Div.

AERODYNAMIC FORCES ON FREIGHT TRAINS. VOLUME 2: FULL-SCALE AERODYNAMIC VALIDATION TESTS OF TRAILER-ON-A-FLAT CAR Test Results Report, Jun. 1976 - Dec. 1977

Prakash B. Joshi Mar. 1978 381 p refs

(Contract DOT-FR-64113)

(PB-281823/5; DOT-FR-78-19-Vol-2; FRA/ORD-76/295.2-Vol-2) Avail: NTIS HC A17/MF A01 CSCL 13F

Aerodynamic forces were measured on fullscale Trailer-on-a-Flat Car (TOFC) configurations and a reliable data base was established for validation of wind tunnel test programs. The drag, side and lift forces were determined on two trailers mounted on an instrumented flat car, each by means of a specially designed force-balance system. Two TOFC configurations were tested under different wind conditions. In addition to the aerodynamic resistance of the trailers, total tractive resistance of the TOFC was measured via instrumented couplers. GRA

N79-10962# Mitre Corp., McLean, Va.
REVIEW OF DOWNTOWN PEOPLE MOVER PROPOSALS: PRELIMINARY MARKET IMPLICATIONS FOR DOWNTOWN APPLICATIONS OF AUTOMATED GUIDEWAY TRANSIT
Nancy B. Mabee and Barbara A. Zumwalt Dec. 1977 144 p refs
(Contract DOT-UT-50016)
(PB-281068/7; MTR-7691; UMTA-IT-06-0176-77-1) Avail: NTIS HC A07/MF A01 CSCL 13B

The potential market for automated guideway transit (AGT) systems in the United States was ascertained from 38 proposals submitted for consideration in UMTA's downtown people mover (DPM) project. These proposals address a range of socioeconomic considerations related to the installation of DPM systems in central business districts. The considerations include application site characteristics, system ridership, system economics, past project planning, local funding sources, related transportation planning activities, related central city redevelopment activities, and environmental impacts. The status of AGT technology in the U.S. is discussed. A summary of the project and site characteristics given in the DPM proposals, and individual summary sheets for each city are included. GRA

N79-10963# Transportation Research Board, Washington, D. C.
PLANNING AND DESIGN OF RAPID TRANSIT FACILITIES
1978 56 p refs
(PB-282600/6; TRB/TRR-662; ISBN-0-309-02691-1) Avail: NTIS HC A04/MF A01 CSCL 13B

The 9 papers in this report deal with the following areas: energy efficient rail transit operation; passenger utilization of local vs express trains for a New York City subway line: a case study; some aesthetic considerations in light rail design; a study of passenger transfer facilities (abridgment); a transit station design process (abridgment); peak-off peak revenue and cost allocation model; contract management in the transit industry; toward the development of an accommodation service policy; and future ridership on New York City's rapid transit system (abridgment). GRA

N79-10964# Systems Technology, Inc., Hawthorne, Calif.
SOLID STATE DATA ACQUISITION AND PROCESSING SYSTEM (SSDAPS). VOLUME 1: SYSTEM SUMMARY. VOLUME 2: DESCRIPTION, OPERATION, AND VERIFICATION TEST REPORT Final Report
Arthur A. Blavelt, Richard A. Peters, and Duane T. McRuer Sep. 1977 97 p
(Contract DOT-HS-5-01212)
(PB-281739/3; STI-TR-1067-1-I; STI-TR-1067-1-II; DOT-HS-803-310-1/2) Avail: NTIS HC A05/MF A01 CSCL 13F

A portable data acquisition and analysis system is described. The system is designed for studies of vehicle dynamics, braking, and driver behavior. As such it consists of a full complement of instrumentation sensors; data acquisition and signal conditioning modules; 62 channel FM/VHF digital telemetry (46 active at this time); and base station with PDP-11 minicomputer, teletype, and digital magnetic tape drive. Several unique features include onboard computations of sideslip velocity and lateral position, road referenced accelerations, and drive line torque, plus an interactive driver display panel. GRA

N79-10965# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: RECLAIMING OF WASTE SOLVENTS, STATE OF THE ART Final Task Report, Aug. 1976 - Nov. 1977
D. R. Tierney and T. W. Hughes Apr. 1978 69 p refs
(Contract EPA-68-02-1874)
(PB-282934/9; MRC-DA-727; EPA-600/2-78-004F) Avail: NTIS HC A04/MF A01 CSCL 13B

A representative plant was defined in order to determine the potential environmental impact of the solvent reclaiming industry. The ratio of the time-averaged maximum ground level concentration of a pollutant to a hazard factor is the source severity. For criteria pollutants, the hazard factor is the ambient of air quality standard in a representative plant, the hydrocarbon source severity is 0.31, and particulate source severity is 0.0085; for selected solvents ranging from acetone to butanol, source severities ranged from 0.0063 to 0.05. Hydrocarbon emissions are controlled using floating roofs, refrigeration, and conservation vents for storage tanks, and packed scrubbers and secondary condensers for distillation units. Particulate control from incinerator stacks is accomplished using wet scrubbers. GRA

N79-10966# Cincinnati Univ., Ohio. Southwestern Ohio Regional Computer Center.
DATA STORAGE AND RETRIEVAL SYSTEM FOR PILOT WASTEWATER TREATMENT RESEARCH. USERS MANUAL Final Report, Apr. 1975 - Sep. 1976
Gregory A. Fish and Stanley L. Forsythe Apr. 1978 108 p
(Contract GS-05S-10030)
(PB-282943/0; EPA-600/2-78-036) Avail: NTIS HC A06/MF A01 CSCL 13B

The computer system described was designed as a data storage and retrieval system for the water reuse project at the Blue Plains Treatment Plant located at Research Triangle Park, North Carolina. The pilot study was intended to evaluate the effectiveness of various processes in removing specific pollutants from wastewater. The six processes being evaluated at Blue Plains were lime clarification, nitrification, denitrification, carbon absorption, filtration, and chlorination. This user's manual describes the programs and files of the system, the use of terminals while using the system and what the user needs to do to operate the five functions of the system. GRA

N79-10967# Westinghouse Research and Development Center, Pittsburgh, Pa.
DISPOSAL OF SOLID RESIDUE FROM FLUIDIZED-BED COMBUSTION: ENGINEERING AND LABORATORY STUDIES Final Report
C. C. Sun, C. H. Peterson, R. A. Newby, W. G. Vaux, and D. L. Keairns Apr. 1978 208 p refs
(Contract EPA-68-02-2132)
(PB-283082/6; EPA-600/7-78-049) Avail: NTIS HC A10/MF A01 CSCL 13B

The quantity and composition of spent sorbents produced by six reference FBC processes were projected. The experimental investigation considered residue from atmospheric and pressured FBC processes, with and without sorbent regeneration, and with and without processing of the residue. Laboratory tests were conducted to determine residue characteristics, leaching behavior, and thermal activity. The environmental impact from land disposal of the residue was assessed. Processing of the spent sorbent and ash was investigated. The potential for at-sea disposal was also assessed. GRA

N79-10968# Stone (Ralph) and Co., Inc., Los Angeles, Calif.
ENVIRONMENTAL ASSESSMENT OF SOLID RESIDUES FROM FLUIDIZED-BED FUEL PROCESSING Final Report, Nov. 1975
Ralph Stone and Richard L. Kahle Jun. 1978 342 p refs
(Contract EPA-68-03-2347)
(PB-282940/6; EPA-600/7-78-107) Avail: NTIS HC A15/MF A01 CSCL 21B

The results of a 2 year study of the environmental assessment of solid residues generated by fluidized-bed combustion (FBC) of coal and gasification of oil are given. A literature search, chemical and physical residue characterization, laboratory leaching studies, and testing of residues in various materials and agricultural applications is included. The data were used to assess the potential for impact on water quality, and the capacity of the disposal environment to attenuate degradation. Residue use was considered for concrete, asphalt, soil cement, and lime/flyash aggrate. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N79-10969* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ANASTIGMATIC THREE-MIRROR TELESCOPE Patent
Dietrich G. Korsch, inventor (to NASA) (Sperry Rand Corp., Huntsville, Ala.) Issued 18 Jul. 1978 6 p Filed 29 Jul. 1977 Supersedes N77-28937 (15 - 19, p 2599) Sponosred by NASA
(NASA-Case-MFS-23675-1; US-Patent-4,101,195; US-Patent-Appl-SN-820498; US-Patent-Class-350-55; US-Patent-Class-350-294) Avail: US Patent Office CSCL 20F

A three-mirror telescope for extraterrestrial observations is described. An ellipsoidal primary mirror, a hyperbolic secondary mirror, and an ellipsoidal tertiary mirror, produce an image in a conveniently located finite plane for viewing.
Official Gazette of the U.S. Patent Office

N79-10970*# National Aeronautics and Space Administration, Washington, D. C.
ON THE PROBLEM OF CONSTRUCTING A MODERN, ECONOMIC RADIOTELESCOPE COMPLEX
A. F. Bogomolov, A. G. Sokolov, B. A. Poperechenko, and V. S. Polyak Jun. 1977 23 p refs Transl. into ENGLISH from Antenny (USSR), v. 24, 1976 p 106-123 Original language doc. announced as A77-31614 Translated by Scientific Translation Service, Santa Barbara, Calif.
(NASA Order JE-654698)
(NASA-TM-75119) Avail: NTIS HC A02/MF A01 CSCL 03A

Criteria for comparing and planning the technical and economic characteristics of large parabolic reflector antenna systems and other types used in radioastronomy and deep space communications are discussed. The experience gained in making and optimizing a series of highly efficient parabolic antennas in the USSR is reviewed. Several ways are indicated for further improving the complex characteristics of antennas similar to the original TNA-1500 64m radio telescope. The suggestions can be applied in planning the characteristics of radiotelescopes which are now being built, in particular, the TNA-8000 with a diameter of 128 m. A.R.H.

N79-10971*# Analytical Decisions, Inc., Arlington, Va.
ASSESSMENT STUDY OF INFRARED DETECTOR ARRAYS FOR LOW-BACKGROUND ASTRONOMICAL RESEARCH Final Technical Report
K. J. Ando Aug. 1978 98 p refs
(Contract NAS2-9858)
(NASA-CR-152169) Avail: NTIS HC A05/MF A01 CSCL 03A

The current state-of-the-art of infrared detector arrays employing charge coupled devices (CCD) or charge injection devices (CID) readout are assessed. The applicability, limitations and potentials of such arrays under the low-background astronomical observing conditions of interest for SIRFT (Shuttle Infrared Telescope Facility) are determined. The following are reviewed: (1) monolithic extrinsic arrays; (2) monolithic intrinsic arrays; (3) charge injection devices; and (4) hybrid arrays. G.Y.

N79-10972# California Univ., Berkeley. Lawrence Berkeley Lab.
TIME-RESOLVED SPECTROPHOTOMETRY OF HZ HERCULIS AND DQ HERCULIS Ph.D. Thesis
G. A. Chanan Jan. 1978 101 p refs
(Contract W-7405-eng-48)
(LBL-7227) Avail: NTIS HC A06/MF A01

The image-tube scanner at the 3 m telescope was employed to study the spectral changes which occur during the pulse period in the optical pulsars HZ Herculis (1.2 s period) and DQ Herculis (71 s period). The data acquisition is described and the tools needed for the data analysis are developed. The results of the observations are presented. The evident relation between the phase shift across the emission line and the so-called 360 deg phase shift through eclipse is discussed. DOE

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N79-10973 Pennsylvania Univ., Philadelphia.
A COMPARISON OF CLUSTERS OF GALAXIES WITH N-BODY SIMULATIONS Ph.D. Thesis
Mitchell Floyd Struble 1978 228 p
Avail: Univ. Microfilms Order No. 7816362

The three-dimensional number density profiles, surface density profiles, the distribution of separation vectors and the velocity dispersion profiles of Wielen's N-body simulations and statistical simulations generated via Monte Carlo techniques are compared with the same data profiles of observed clusters of galaxies. Computed masses for the simulations via the virial theorem (as customarily approximated for observed clusters) indicate that a virial excess approximately 2 - 5 can be obtained, but virial excesses > 5 cannot be so explained. Since some observed clusters have virial excesses approximately 10, one must invoke hidden mass to account for the bulk of a cluster's mass. In addition, the general absence of mass segregation in rich clusters forces the conclusion that the missing mass must be in the form of many low mass intergalactic stars against which the visible galaxies are relaxing, delaying mass segregation among them. Dissert. Abstr.

N79-10974 Rochester Univ., N. Y.
DEVELOPMENT OF A TWO-DIMENSIONAL, EULERIAN STELLAR EVOLUTION CODE Ph.D. Thesis
Sheridan Alan Simon 1978 424 p
Avail: Univ. Microfilms Order No. 78-15306

A stellar evolution code with a build-in method for dealing in a self-consistent way with the gravitational field of a non-spherical object was developed by writing a set of seven nonlinear partial differential equations which describe the quasistatic evolution of axisymmetric stellar models constituted of non-barytropic materials. The equations were linearized and solved by a relaxation technique. The solution was carried out by numerical methods on an IBM 360/65 computer. The evolutionary sequence of pre-White Dwarf models produced by this technique were in close quantitative agreement with models produced by Vila using the same equation of state but the standard Henyey stellar evolution code. The approach can be utilized to produce accurate evolutionary sequences of models of stars. The computer storage requirements and time of calculation are larger than, but competitive with the standard Henyey method.
Dissert. Abstr.

N79-10975 City Univ. of New York.
INVESTIGATIONS IN HOMOGENEOUS COSMOLOGIES Ph.D. Thesis
Christ Ftaclas 1978 133 p
Avail: Univ. Microfilms Order No. 7816678

Spatially homogeneous relativistic cosmological models are explored and a number of new properties are presented. It is demonstrated that motions associated with rotational symmetry need not preserve the homogeneity of physical fields. A model is presented in which physically defined preferred directions violate rotational symmetry. Some perturbed models are given which exhibit shear, expansion and nonvanishing vorticity. In addition, an introduction to the mathematical framework of relativity is included with particular emphasis on exterior calculus and the theory of symmetric spaces. Dissert. Abstr.

N79-10976 Washington Univ., Seattle.
CONVECTION IN THE SURFACE LAYERS OF THE SUN AND THE STARS Ph.D. Thesis
George Driver Nelson 1978 147 p
Avail: Univ. Microfilms Order No. 7814477

A two-dimensional steady-state model of the convection in the surface layers of the sun and stars is developed. Radiative energy transport through the inhomogeneous photosphere is described with the two-dimensional transfer equation in the gray Eddington approximation. The magnitude and extent of the vertical velocity overshoot as a function of cell size and drag length is discussed. Dissert. Abstr.

N79-10977 California Univ., Berkeley.
THE SCORPIUS-OPHIUCHUS DIFFUSE INTERSTELLAR CLOUD Ph.D. Thesis
Priscilla Chapman Frisch 1977 130 p
Avail: Univ. Microfilms Order No. 7731359

The diffuse cloud in front of the Scorpius and Ophiuchus constellations was selected as a good region for testing theories about the interstellar formation of the diatomic radicals CH(+) and CH(q). Observations made for this study establish that the main absorption lines from interstellar CH(+) and CH(q) are formed at different velocities in front of chi Oph, and perhaps rho Oph, suggesting that these molecules are formed in different clouds. The cloud containing CH(+) is shown to be related to 21 cm filamentary structures in front of several Sco-Oph stars. Multiple cloud structure in front of zeta Oph is explained in terms of a model in which a shock wave propagates through a neutral hydrogen region. In this model, the CH(+) is formed at the rear of the transition zone and the CH(q) and other neutrals are formed in the cool post-shock cloud. Dissert. Abstr.

N79-10978*# Cornell Univ., Ithaca, N. Y. Laboratory of Atomic and Solid State Physics.
ASTROPHYSICAL MATERIALS SCIENCE: THEORY Final Technical Report, Aug. 1972 - Sep. 1978
Neil W. Ashcroft Sep. 1978 192 p refs
(Grant NGR-33-010-188)
(NASA-CR-157782) Avail: NTIS HC A09/MF A01 CSCL 03B

Research papers of the discoveries and work carried out over the past six or so years are presented. Hydrogen and helium constitute by far the most abundant of the elements and it is no accident that the research has focussed heavily on these elements in their condensed forms, both as pure substances and in mixtures. The research has combined the fundamental with the pragmatic. G.Y.

N79-10979# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
CRITICAL RATES OF STELLAR MASS LOSS
D. S. P. Dearborn (Arizona Univ., Tucson) and J. B. Blake 25 Sep. 1978 10 p refs
(ATR-78(9552)-2) Avail: NTIS HC A02/MF A01

Mass loss will cause a star to be overluminous for its mass (though less luminous than a star of its original mass) and, for moderate mass-loss rates, the luminosity decreases at the same rate as the mass contained in the convective core decreases causing the main sequence lifetime to remain unchanged. Mass loss can also expose layers where N-14 has been enhanced via the CNO tricycle and, in extreme cases, can produce a stripped helium core resembling a Wolf-Rayet Star. While many of these phenomena are more sensitive to the total mass removed than the formalism used to represent the mass loss, significant differences will result for the same average mass-loss rate depending on whether the mass was removed early or late. There appears to be a critical mass loss rate which depends on initial mass and separate those models which continue to evolve in a relatively normal (though subluminous) manner, and those models which evolve to a Wolf-Rayet configuration. G.Y.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N79-10980 Washington Univ., Seattle.
THE AEROSOL CONTENT IN THE JOVIAN LOWER STRATOSPHERE AND UPPER TROPOSPHERE DETERMINED BY SATELLITE ECLIPSE OBSERVATIONS Ph.D. Thesis
Dale Wilford Smith 1978 131 p refs
Copyright. Avail: Issuing Activity

Twelve eclipses of Galilean satellites previously observed with a 200 inch telescope and a multichannel spectrometer were analyzed. The theory and method of eclipse light curve reduction are discussed. Satellite limb darkening values and aerosol extinction coefficients determined from each eclipse light curve are presented. The aerosol structure in altitude and latitude is discussed as well as restrictions on particle size and composition. Contemporary radiative equilibrium Jovian atmosphere models are used and computation methods are included. A.R.H.

N79-10981 California Inst. of Tech., Pasadena.
HIGH SPATIAL RESOLUTION INFRARED IMAGING OF JUPITER: IMPLICATIONS FOR THE VERTICAL CLOUD STRUCTURE FROM FIVE-MICRON MEASUREMENTS Ph.D. Thesis
Richard John Terrile 1978 156 p
Avail: Univ. Microfilms Order No. 7816959

The design and construction of a 5 micron imaging system used at the Hale 5 m(200 inch) telescope to acquire high spatial resolution infrared images of Jupiter is described. Constraints are derived for the optical properties of the upper Jovian clouds. A three layer cloud model is developed which is consistent with all of the observational data at 5 microns. The three model cloud layers have cloud top temperatures of T sub 1 less than or equal to 190 K (presumably T sub 1 approximately equal to 140 K), T sub 2 = 228 + or - 2 K and T sub 3 = 292 + or - 8 K. Dissert. Abstr.

N79-10982 Rice Univ., Houston, Tex.
A SELF-CONSISTENT MODEL OF A ROTATING JOVIAN MAGNETOSPHERE Ph.D. Thesis
James Franklin Carbary 1977 60 p
Avail: Univ. Microfilms Order No. 7814745

A rotation-dominated model of the Jovian magnetosphere is constructed in which the current distribution is consistent with the magnetic field. With the assumptions of an ionospheric plasma source, no pitch-angle scattering, and aligned rotation, centrifugal force is balanced against magnetic stress. The resulting dynamical equation is derived for a self-consistent field having a single adjustable parameter related to the plasma source strength. An iterative numerical method is used to solve this equation. The self-consistent field resembles a radially-distorted dipole field and does not resemble a flat magneto-disc, as has often been inferred from the Pioneer data. Centrifugal forces open the field at radial distances approximately 10% greater than those expected for a pure dipole field. For expected source strengths, this critical opening radius is about 50 R sub J. Dissert. Abstr.

N79-10983*# National Aeronautics and Space Administration, Washington, D. C.
INFRARED RADIATION OF VENUSIAN CLOUDS
L. V. Ksanfomaliti, Ye. V. Dedova, L. F. Obukhova, N. V. Temnaya, and G. F. Filippov Oct. 1978 23 p refs Transl. into ENGLISH of "Infrakrasnoye Izlucheniye Oblakov Venery", Rept. PR-289 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1976 p 1-24 Transl. by Scientific Translation Service, Santa Barbara, Calif. (Contract NASw-3198)
(NASA-TM-75539; PR-289) Avail: NTIS HC A02/MF A01 CSCL 03B

The thermal infrared emission of Venus measured by Venera-9 and Venera-10 is analyzed. The emission of the night side corresponds to a brightness temperature of 244 K. The brightest temperature of the day side is 233-234 K. The extent of the upper layer of clouds, in which the thermal emission is formed, is 4-6 km. The altitude of the emitting layer above the surface of the planet (64-67 km) is determined from the brightness temperature and the existing models of the atmosphere of Venus. In some cases, correlation is noted between the inhomogeneity and the details of the ultraviolet image. The day side temperatures strangely coincide with the freezing point of sulfuric acid at a concentration of 66-77%. J.M.S.

N79-10984*# National Aeronautics and Space Administration, Washington, D. C.
WORKING MODEL OF THE ATMOSPHERE AND NEAR PLANETARY SPACE OF JUPITER
V. I. Moroz, ed. Oct. 1978 58 p refs Transl. into ENGLISH of "Rabochaya Model Atmosfery i Okoloplanetnogo Prostranstva

Yupitera", Rept. PR-282 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1976 p 1-52 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75564; PR-282) Avail: NTIS HC A04/MF A01 CSCL 03B

Basic physical characteristics of Jupiter, its gravitational field, atmosphere, electromagnetic radiation, magnetosphere, meteorite situation and satellites are presented in tables, graphs and figures. Means of observation of the atmosphere and three models of the atmosphere are presented and analyzed. A.R.H.

N79-10985*# Santa Clara Univ., Calif. Dept. of Physics.
[LUNAR MAGNETIC PERMEABILITY, MAGNETIC FIELDS, AND ELECTRICAL CONDUCTIVITY TEMPERATURE] Final Report, 1 Sep. 1975 - 31 Aug. 1978
Curtis W. Parkin 31 Aug. 1978 131 p refs
(Grant NsG-2075)
(NASA-CR-157784) Avail: NTIS HC A07/MF A01 CSCL 03B

In the time period 1969-1972 a total of five magnetometers were deployed on the lunar surface during four Apollo missions. Data from these instruments, along with simultaneous measurements from other experiments on the moon and in lunar orbit, were used to study properties of the lunar interior and the lunar environment. The principal scientific results from analyses of the magnetic field data are discussed. The results are presented in the following main categories: (1) lunar electrical conductivity, temperature, and structure; (2) lunar magnetic permeability, iron abundance, and core size limits; (3) the local remnant magnetic fields, their interaction with the solar wind, and a thermoelectric generator model for their origin. Relevant publications and presented papers are listed. G.Y.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N79-10986 Arizona Univ., Tucson.
AN INFRARED INVESTIGATION OF THE TEMPERATURE STRUCTURE OF THE SOLAR ATMOSPHERE Ph.D. Thesis
Richard George Allen 1978 219 p
Avail: Univ. Microfilms Order No. 7818617

Narrow-band continuum limb darkening observations of the sun were taken during the first half of 1974. These observations were made at eighteen wavelengths between 10840.10 and 104007.55 A. A daily set of observations at any one of the observational wavelengths consisted of twelve drift scans across the solar disk. An excellent fit to the observations was ultimately achieved with a two-component LTE solar model. The hot component of this model represents the half of the solar surface that is above the median temperature at each depth; while the cool component represents the half of the solar surface that is below the median temperature. Most of the observations are fitted to within the expected errors by this model. Discrepancies below 4500 A are probably due to line blanketing. The splitting between the hot and cool components of the model is consistent with current estimates of the rms intensity fluctuations in the solar atmosphere. Dissert. Abstr.

N79-10987# Manila Observatory (Philippines).
LOW LATITUDE PC 3 AND PC 4 MICROPULSATIONS Final Report, 1 Jul. 1975 - 30 Jun. 1977
Victor L. Badillo 28 Jan. 1977 10 p
(Contract F19628-76-C-0026)
(AD-A057135; AFGL-TR-77-0294) Avail: NTIS HC A02/MF A01 CSCL 08/14

Equatorial Pc 3 and Pc 4 were obtained from normal run magnetogram from January to June 1976 using the eye alone. Micropulsations may possibly be used to derive information on incoming solar particles. Author (GRA)

N79-10988# Department of Energy, New York. Environmental Measurements Lab.
USE OF THE WOLF NUMBER TO ESTIMATE SOLAR MODULATION
Keran OBrien Dec. 1977 10 p refs
(EML-335) Avail: NTIS HC A02/MF A01

An approximate relation between the solar modulation of galactic cosmic rays, in the heliocentric potential model, and the mean annual Zurich sunspot number (Wolf number) was obtained. The heliocentric potential (in MV) is shown to be approximately 4.34 times the Wolf number with a standard deviation of about 160 MV. This ratio allows an estimate of solar activity during periods where neutron monitor data are missing. The mean level of solar activity over the last 10 solar cycles, is based on the mean annual sunspot number, about 200 MV. DOE

N79-10989# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 404, APRIL 1978. PART 1: PROMPT REPORTS. DATA FOR MARCH 1978 - FEBRUARY 1978
Helen E. Coffey Apr. 1978 149 p
(PB-283244/2; SGD-404-Pt-1; NOAA-78051604) Avail: NTIS HC A07/MF A01 CSCL 03B

The data for March 1978 reported on: alert period, daily solar indices, solar flares, solar radio waves, solar X-ray radiation, coronal holes, solar wind measurements, inferred IP magnetic field polarities, mean solar magnetic field, and geomagnetic substorms . Data for February 1978 also reported on: daily solar activity center, sudden ionospheric disturbances, solar X-ray radiation, solar radio waves, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N79-10990# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 404, APRIL 1978. PART 2: COMPREHENSIVE REPORTS. DATA FOR OCTOBER 1977 - SEPTEMBER 1977 AND MISCELLANEA
Helen E. Coffey Apr. 1978 75 p
(PB-283245/9; SGD-404-Pt-2; NOAA-78051605) Avail: NTIS HC A04/MF A01 CSCL 03B

The data for October 1977, September 1977, and Miscellaneous reported on: active regions, synoptic solar maps, solar flares, solar radio waves, energetic solar particles and plasma, solar X-ray radiation, synoptic chart, abbreviated calendar record, regional flare index, solar radio waves January 1978, and solar X-ray radiation June - September 1977. GRA

N79-10991# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA: PROMPT REPORTS
Helen E. Coffey May 1978 163 p
(PB-283862/1; SGD-405-Pt-1; NOAA-78061903) Avail: NTIS HC A08/MF A01 CSCL 03B

The data for April 1978 reported on: alert period, daily solar indices, solar flares, solar radio waves, solar X-ray radiation, coronal holes, inferred IP magnetic field polarities, mean solar magnetic field, solar wind measurements, geomagnetic substorms, and magnetograms of geomagnetic storm. Data for March 1978 also reported on: daily solar activity center, sudden ionospheric disturbances, solar X-ray radiation, solar radio waves, cosmic rays, geomagnetic indices and radio propagation indices. The North American magnetometer network is listed. GRA

N79-10992# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA: PROMPT REPORTS
Helen E. Coffey May 1978 61 p
(PB-283863/9; SGD-405-Pt-2; NOAA-78061904) Avail: NTIS HC A04/MF A01 CSCL 03B

The data for November 1977, October 1977, and Miscellaneous reported on: active regions, synoptic solar maps, solar flares, solar radio waves, and energetic solar particles and plasma, synoptic chart, abbreviated calendar record, regional flare index, solar radio waves for February 1978 and geomagnetic indices January and February 1978. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N79-10993 New Hampshire Univ., Durham.
COSMIC RAY ISOTOPIC COMPOSITION: NEON THROUGH IRON Ph.D. Thesis
George Arthur Simpson 1977 121 p
Avail: Univ. Microfilms Order No. 7814394

A balloon-borne plastic scintillator was used to determine the isotopic composition (neon through iron) of cosmic rays. Interaction rejection with consistency criteria, calibration of the instrument using flight data, and charge and mass assignments for each event are included in the data analysis along with methods for treating the nonlinear responses of the scintillator. Isotopic mass histograms are presented and nuclear interaction corrections are traced through the instrument and the atmosphere. A conventional propagation model was used to translate the observations through the interplanetary medium and the galaxy to the sources. The significance of the results are discussed in the context of the published nucleosynthesis theory. Results indicate that the isotopic abundances of cosmic rays at the source differ significantly from the soalr system abundances.

Dissert. Abstr.

N79-10994*# National Aeronautics and Space Administration, Washington, D. C.
ON THE NATURE OF THE SOURCES OF HARD PULSE X-RAY RADIATION
I. S. Shklovskiy Oct. 1978 15 p refs Transl. into ENGLISH of "O Prirode Istochnikov Impulsnogo Zhestkogo Rentgenovskogo Izlucheniya", Rept. PR-280 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1976 p 1-12 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75561; PR-280) Avail: NTIS HC A02/MF A01 CSCL 03B

Besides the identified sources of cosmic pulse X-ray radiation with globular clusters NGC 6624, NGC 1851 and MXB 1730-335 several new identifications were made. The source in Norma was probably identified with globular cluster NGC 5927, the source in Aquila with globular cluster NGC 6838 (M71), and the source in Puppis with globular cluster NGC 2298. Gamma pulses discovered by the Vela satellites and X-ray pulses thoroughly measured by the SAS-3, Ariel-5, and ANS satellites are thought to be the same phenomenon. The sources of such a radiation must be some kind of peculiarity at the central part of globular clusters; it is most probably a massive black hole. The sources of hard pulse radiation which cannot be identified with globular clusters are considered to be a new kind of galactic object, invisible globular clusters, which are naked nuclei of globular clusters. A.R.H.

99 GENERAL

N79-10995*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
ANTIAIRCRAFT SYSTEM AND METHOD EMPLOYING SMALL PROJECTILES Patent Application
Ming H. Tang, inventor (to NASA) Filed 14 Feb. 1978 16 p
(NASA-Case-FRC-11006-1; US-Patent-Appl-SN-877786) Avail: NTIS HC A02/MF A01 CSCL 15C

A system and method are presented for disabling low flying aircrafts without the need to aim destructive matter at the aircrafts. The novelty of the invention is believed to be based on the dispersion of elements in an airspace which an acquired aircraft has to traverse, without having to aim the elements at the specific aircraft. The elements, by coming in contact with the aircraft, contribute to its destruction. NASA

N79-10996# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD BULLETIN. TECHNICAL PROGRAM, 1979
Aug. 1978 35 p
(AGARD/BULL-78/2) Avail: NTIS
HC A03/MF A01

A chronological list of meetings tentatively scheduled for 1979 is presented along with a description of the activities planned for the individual panels, the consultant and exchange program, and the military studies committee. The total budget required to support AGARD's technical studies program for the coming year is included with a list of publications to be initiated or released. A.R.H.

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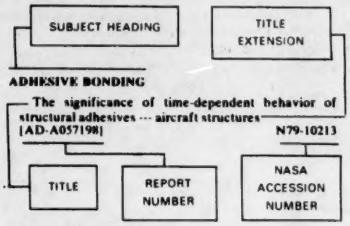
Typical Subject Index Listing



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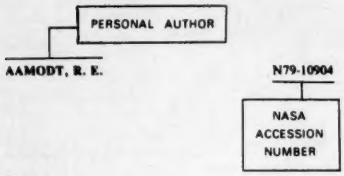

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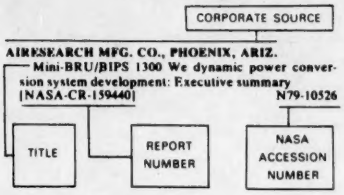

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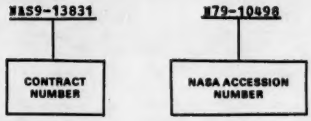

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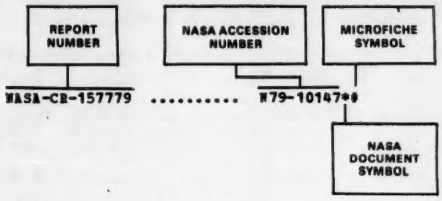

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